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PHYSICAL DEMANDS OF ARMY MILITARY OCCUPATIONAL SPECIALTIES:  
CONSTRUCTING AND APPLYING A CROSSWALK TO EVALUATE THE  
RELATIONSHIP BETWEEN OCCUPATIONAL PHYSICAL DEMANDS AND  
HOSPITALIZATIONS

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OCCUPATIONAL PHYSICAL DEMANDS AND HOSPITALIZATIONS**

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## **LIST OF ACRONYMS**

AP	Army Pamphlet
DoD	Department of Defense
MOS	Military Occupational Specialty
DMDC	Defense Manpower Data Center
ICD-9-CM	International Classification of Disease, 9 <sup>th</sup> Revision, Clinical Modification
OR	Odds Ratio
STANAG	NATO Standardized Agreement
TAIHOD	Total Army Injury and Health Outcomes Database

## EXECUTIVE SUMMARY

Army Military Occupational Specialties (MOSs) for enlisted Soldiers are categorized by their relative level of physical demands. Ideally this information should be used to insure a Soldier possesses the necessary physical attributes to safely perform an assigned job. The objectives of this report are to compare rates of injury among common MOSs stratified by light, moderate and heavy levels of physical job demands. We hypothesize that Soldiers placed in MOSs with higher levels of occupational physical demands will be at greatest risk for occupational injury, followed by those in moderately demanding jobs. We hypothesize that Soldiers in the least physically demanding jobs will be at lowest risk for occupational injury. A secondary objective of this report is to document the technical and analytic steps taken in order to create a crosswalk that allowed us to follow trends in military occupation codes over time.

The physical demand levels of each enlisted MOS are classified and described in Department of the Army Pamphlet 611-21. The Army Pamphlet also outlines the procedures for evaluating physical abilities throughout a Soldier's career to prevent mismatches between the physical demands of a job and the physical abilities of a Soldier. While there is stated intent to ensure that Soldiers are appropriately matched to occupations based on the physical requirements of a position and the physical capabilities of the individual, it is doubtful such evaluations occur.

With escalating rates of musculoskeletal disability, there is cause for concern about whether Soldiers are appropriately evaluated and then placed in jobs with occupational demands suitable for their physical capabilities throughout their careers. Failure to properly match physical capabilities with physical demands of a job will likely lead to excess injury and disability. While it is expected that there will be variation in the type of injury patterns seen across various occupational specialties because of differential exposures, it is nonetheless important to understand and prevent job-related injuries.

In order to determine whether Soldiers are properly matched to jobs with varying levels of physical demands, it is necessary to compare occupational injury and disability risk patterns across MOSs with varying levels of physical demands. A temporal assessment of the link between occupational exposures and subsequent injury and disability requires the creation of a crosswalk to correctly identify and follow occupational exposures across time. The crosswalk is also necessary in order to link physical demands associated with various occupations to adverse health outcomes. However, what might appear to be a relatively simple endeavor is actually quite challenging. First, there are many MOSs. In 2006 alone there were over 300 MOSs in use to describe the many enlisted military occupations and, historically, there have been over 700 codes used to categorize enlisted military occupations from 1980 to 2006. Second, MOSs change over time in unpredictable ways (e.g., an occupation can be given a new MOS code, while the old code is recycled or dropped; occupations change

over time as some jobs become obsolete or new jobs are added). Third, the latest job demands ranking was published in 1999 and it is not electronically available, so job-demands data for each specific MOS have to be located by reading through the list and then hand-entering the information, which is a very time-consuming but necessary task for any large-scale analyses. The physical job demands data have not been updated since the report was commissioned in 2000, so any new MOSs added after 2000 have not been categorized. To address these challenges we have identified the top 45 most common MOSs in 2000 across three levels of physical demands: light, moderate and heavy. Using a number of primary data sources, we have traced changes in these 45 occupational groups backward and forward in time. We then linked these occupational exposures (light, moderate, heavy demands) to hospitalization outcomes.

Results indicate that the odds for experiencing an injury hospitalization increased with increasing level of physical demand. In contrast, the odds of experiencing a hospitalization for any (all) cause(s) were lowest for Soldiers in the highest physical demands jobs, followed by Soldiers in moderate demands jobs; Soldiers in the light demand jobs were at greatest risk for any-cause hospitalization. On-duty serious accidents (those resulting in an injury hospitalization) occur more frequently among heavy physically demanding jobs. Soldiers in 11B (Infantrymen), 19D (Cavalry Scout) and 11C (Indirect Fire Infantrymen) were at greatest risk for on-the-job injuries resulting in hospitalization within the top 15 selected heavy physically demanding occupations.

Our findings suggest that the MOS assignment and reclassification processes are in need of revisions or more thorough implementation. Furthermore, the dynamic nature of MOS nomenclature over time makes the study of any temporal patterns or risk factors for injury or disability within an occupational cohort difficult. The ability to crosswalk MOS codes over time is a great advantage for the study of any long-term health or behavioral trends among specific military occupations of interest. More research is needed that explores long-term chronic conditions and disability related to occupational physical demand and to clarify the independent influence of job demands once demographic factors are controlled.

## INTRODUCTION

In 2006 there were over 300 enlisted military occupational specialties (MOSs) in the U.S. Army comprising job tasks as diverse as infantrymen, medical specialists, and intelligence agents. The Department of the Army Pamphlet (AP) 611-21 classifies each enlisted MOS according to relative physical demands of a job and also lists the physical duties required of each MOS (10). According to AP 611-21, the physical performance duties of “should be used to assess the need for [a Soldier’s] MOS reclassification due to physical limitations and to aid in the selection of suitable MOS[s] for those Soldiers requiring reclassification.”

Despite the stated intent in AP 611-21 to ensure appropriate matching of Soldiers to jobs relative to physical abilities, there has been concern that Soldiers are not always physically capable of performing their assigned duties. A 1996 General Accounting Office report questioned whether service members in all military branches were able to perform all the physically demanding tasks of their assigned occupations (19). Furthermore, the National Research Council states that there is poor documentation linking level of individual physical fitness to military occupational performance (14). The DoD Joint Technology Coordinating group-5 and U.S. Medical Research and Material Command reviewed military physical fitness standards and concluded that there is a need to better match occupational physical demands with individual physical abilities. Moreover, the report concluded that baseline fitness standards do not adequately represent the level of physical demand required by some military occupational specialties (15). A 1998 review by Costello also concluded that individual performance on the Army Physical Fitness test did not translate into ability to perform the physically demanding tasks of a given MOS (8). This has been documented among active-duty, as well as among military reservists (17), rendering the need to appropriately match Soldiers to jobs according to physical capabilities ever more crucial.

In contrast to these reports, some studies point to evidence that at least some Soldiers are being appropriately matched to occupations suitable for their relative physical capabilities. A 2007 report by Sharp et al. that directly evaluated how well light-wheel mechanics (MOS 63B) perform the tasks required by their MOS (16) found that most 63B Soldiers were able to perform the physically demanding tasks of their MOS. Likewise, Cooper and Arabian’s 2002 survey of active-duty military in physically demanding jobs found that over 90% of respondents said that personal physical strength was not a hindrance to their job performance. This was generally corroborated by their supervisors who reported that over 85% of their Soldiers did not have prohibitive physical strength problems (7).

Nevertheless, possible mismatches between Soldiers and highly demanding occupations present cause for concern, as rates of musculoskeletal disability escalate in the Army at large (4, 5). Assuring that enlisted Soldiers are properly matched to occupations appropriate for their level of fitness, strength and physical capabilities is important for the prevention of job-related injuries or disabilities. Some Soldiers in

certain high-demand occupations experience higher rates of specific types of injuries and disabilities, suggesting that the physical demands of those jobs may not have been properly matched with the physical capabilities of those Soldiers. A 1997 study by Amoroso et al. found acute back injury hospitalization rates were highest among female Medical Specialists and male Motor Transport Operators; hospitalization rates for acute derangement of the knee were higher for female Chemical Operations Specialists and both male Equipment Records clerks and male Parts Specialists and male Medical Specialists (3). A study by Lincoln et al. (2002) found Soldiers in electronic equipment repair and other technical occupations to be at increased risk for overall disability. The study also showed that, among men, increased risk of disability discharge was associated with jobs of heavier physical demand, while holding medium physical demanding jobs yielded a decreased risk for back-related disabilities (13). Dunn et al. (2003) found correlations between musculoskeletal injuries and Army Soldiers in combat, communications and intelligence and craft-related occupations. That same study, however, did not find significant relationships between occupational physical demand and disability, but attributed this lack of association to either the interaction of rank or to incomplete data (12).

In order to determine whether Soldiers are serving in jobs that match their physical abilities, it is necessary to compare occupational injury and disability risk patterns across MOSs. However, what might appear to be a relatively simple endeavor is actually quite challenging because of the way in which MOS categories are named and coded and in which the MOS groupings change over time. Nearly 1,400 MOS codes have been used to describe the many occupations within the military from 1980 to 2006, over 700 of which were used to denote enlisted military occupations. A temporal assessment of the link between occupational exposures and subsequent injury or disability requires the creation of a crosswalk to correctly identify and follow occupations (and thus occupational exposures) across time. In addition, the crosswalk is necessary as part of the process to link data on physical demands associated with various occupations to injury.

There are several challenges related to this task. The large number of MOSs over time change in unpredictable ways (e.g., a given job type might, at some point, be assigned a different code and the old code assigned to an entirely new job or simply dropped; occupational specialties also change over time as some jobs become obsolete or new jobs are added). Also, the job demands ranking scale is not available as an electronic database. The job-demands data for each specific MOS have to be located and hand-entered, which is a very time-consuming but necessary task for any large-scale analyses. In addition, physical job demands data have not been updated since the report was published in 1999. Thus, a crosswalk is needed that allows us to follow MOSs from the year in which the physical demands scale was created to comparable MOSs prior to and after that year.

The objectives of this report are to compare rates of injury among common MOSs stratified by light, moderate and heavy levels of physical demand. We hypothesize that Soldiers placed in MOSs with higher levels of occupational physical

demands will be at greatest risk for occupational injury, followed by those in moderately demanding jobs. We hypothesize that Soldiers in the jobs that are least physically demanding will be at lowest risk for occupational injury. If the data support this hypothesis, then this could suggest that the Army should reconsider how Soldiers are assigned to jobs and/or should more actively and systematically evaluate Soldiers' abilities to perform their jobs through their careers, and/or the jobs themselves are too demanding and hazardous even for highly fit and trained Soldiers. A secondary objective of this report is to document the technical and analytic steps taken in order to create a crosswalk that will allow us to follow trends in military occupation codes over time.

## **METHODS**

### **THE DATA**

Data for this study came from the Total Army Injury and Health Outcomes Database (TAIHOD) (3, 6), which uses encrypted individual identifiers to link records on individual Soldiers from a variety of U.S. Department of Defense administrative and health data sources. TAIHOD components used include the Defense Manpower Data Center (DMDC), which contains personnel records with occupational information and, therefore, MOS codes; and the Patient Administration Systems and Biostatistics Activity database, which contains information on inpatient hospitalizations.

### **THE ARMY PHYSICAL DEMANDS RATINGS**

A 1976 report to Congress by the General Comptroller of the United States called for accurate and objective physical standards to measure an individual's physical abilities as they relate to military occupations (18). As more women were entering the military, male-oriented combat restrictions were causing limited or inappropriate assignment of women to occupations based on their physical capabilities, calling for revised measures of physical ability and job-related physical duties. Ratings of physical demands for military occupations were first introduced in 1982 by the Women in the Army Policy Review Group in response to the 1976 report, and gender-neutral physical standards were developed (10, 11).

The job demands scale is ordered from light physical demand to very heavy physical demand with five categories: light, medium, moderately heavy, heavy, and very heavy. Physical demands are determined by the lifting requirements of the job:

Light	Lift, on an occasional basis, a maximum of 20 pounds with frequent or constant lifting of 10 pounds
Medium	Lift, on an occasional basis, a maximum of 50 pounds with frequent or constant lifting of 25 pounds
Moderately Heavy	Lift, on an occasional basis, a maximum of 80 pounds with frequent or constant lifting of 40 pounds
Heavy	Lift, on an occasional basis, a maximum of 100 pounds with frequent or constant lifting of 50 pounds
Very Heavy	Lift, on an occasional basis, over 100 pounds with frequent or constant lifting in excess of 50 pounds

Army Pamphlet 611-21 (10) provides information on physical demand level assignments for enlisted MOS codes. Prior experience with MOS physical demands classification led us to confidently collapse demand categories into 3-levels of physical demands for analysis. Light and medium physically demanding jobs were collapsed as “light;” moderately heavy remained as its own category (“moderate”); and heavy and very heavy physically demanding jobs were collapsed into “heavy.” This was done to facilitate interpretation of findings, improve homogeneity of job demands categories and simplify the task of hand-coding all MOSs with a job demands code.

## **OCCUPATIONAL INJURY**

Occupational injuries were evaluated using injury hospitalization data. Hospital data used for this study included dates of care, diagnostic codes and cause of injury codes. Diagnostic codes are recorded according to International Classification of Disease, 9<sup>th</sup> Revision, Clinical Modification (ICD-9-CM). Hospitalizations can contain up to eight ICD-9-CM codes denoting both the primary and subordinate diagnoses. A hospitalization was considered an injury-related event when an injury diagnosis (ICD-9-CM codes 800-995) appeared in the primary diagnostic position of the hospital record. Likewise, a hospitalization was classified as a musculoskeletal-related event by the presence of a musculoskeletal diagnosis (ICD-9-CM codes 710-740) in the primary position.

When a hospitalization contains an injury diagnosis, administrative recorders are directed to complete a field for a range of codes that signify the cause of (“injury”) and nature surrounding (“trauma”) a specific injury defined by a North Atlantic Treaty Organization Standardization Agreement 2050 (STANAG). These are similar to the civilian use of E-codes. Unlike civilian hospitalization systems, where coding of injury causes is often incomplete and varies dramatically from state to state (9), the military system achieves a much higher rate of reporting cause of injury (virtually 100%). “Trauma” codes, which address intent and occupational exposures, are more likely to

be coded as unknown than the “injury” (proximal cause) portion of the STANAG code (1, 2). However, when available, these STANAG “trauma” codes can signify, among other details, if an injury was sustained on- or off-duty.

## **STUDY POPULATION**

The initial potential study pool comprised all active-duty Army Soldiers between 1980 and 2006. There were 3,449,097 Soldiers on active duty between 1980 and 2006.

## **ANALYSES**

### **Constructing the MOS Crosswalk and Linking to Job Demand Classifications**

Because construction of the MOS crosswalk was complicated and time consuming and the job demands codes had to be hand-entered, we decided to begin with a single year in order to test our approach and refine our methods. We decided to focus on the most common MOSs in 2000, reasoning that since the AP 611-21 was most recently updated in 1999, 2000 data would be the first full year that the MOS codes and their respective physical demand categories were presumably in effect and, thus, findings would be most relevant to Soldiers on active duty in that year.

We used a Soldier’s last available DMDC personnel file for the year 2000 (Soldiers can have up to 2 personnel records per year in the TAIHOD) to identify their MOS. We also simplified our approach by focusing just on the most common MOSs, by population. After identifying the most common MOSs and insuring that we had representation of common jobs in all three job demands categories, we extended our assessment by identifying Soldiers in these top MOSs in prior and later years of the study period (1980– 2006). Details are provided below.

To identify the most common MOS codes, we rank ordered all MOS codes in the year 2000 by frequency from largest to smallest. Military occupations that were eliminated or obsolete by 2000 were not represented. There were 469,262 Soldiers on active duty in the year 2000, 393,301 (83.81%) were males, 75,474 (16.08%) were females, and 517 (0.11%) Soldiers were of unknown gender. The mean age for the entire 2000 active-duty Army population was 27.34 ( $\pm$  6.69), 27.48 ( $\pm$  6.67) for males, and 26.60 ( $\pm$  6.84) for females.

The data on job demands rankings was hand-entered for each of MOS. Of the top 50 most common MOS codes in 2000, 62% (N=31) were of heavy physical demand, 26% (N=13) were moderate, and 8% (N=4) were of light physical demand. Two of the 50 most common MOS codes in 2000 (Recruiter [79R] and Practical Nurse [91C]) were not assigned a physical demand rating in the AP 611-21.

In order to have a representative sample of all the physical demand levels, we selected the top15 MOSs within each of the three physical demand categories: heavy, moderate and light (comprising 64% of the total population) for analysis. The remainder



of this report focuses on these 45 MOSs representing the 15 most common light-, 15 most common medium- and 15 most common heavy-demands jobs in the Army in 2000. The first stage of this report (Table 1 and its related text) describes the population in the most common MOSs as identified by a Soldier's last DMDC personnel record (N=300,356).

Once the key MOSs were identified, the next step was to expand our population in the year 2000 by searching for the appearance of these codes anywhere in a Soldier's 2000 personnel files. Since our original approach to identifying common MOSs was to take the last MOS code on record in 2000, if a Soldier held a MOS code of interest in June but a different MOS code (not within the top 45 codes) in December, that Soldier would have been missed by our original MOS detection described above. By applying our expanded approach of searching for the existence of the top 45 codes in any 2000 record for a Soldier, we were able to increase our study population. For Soldiers with an MOS of interest in June 2000 (for example, heavy) and another MOS of interest in December 2000 (for example, light), one file per Soldier in 2000 was selected for analysis. The resulting study population for analysis was 305,708 Soldiers. Tables 2-4, and their accompanying text, use this expanded 2000 study population (N=305,708).

The final step in this process was to extend the analysis to include Soldiers in these key occupational groups who were on active duty during prior and more recent years. In order to do this, we needed to identify Soldiers in each of the top 45 MOSs of interest within each 6-month DMDC file for each MOS over the 27 year study period. This meant careful review of data within each of the 54 six-month files for each of the 45 jobs, or a total of 2,430 analytic reviews. Since MOS codes are often changed, eliminated or recycled, this time-intensive approach was necessary in order to carefully follow each occupation from 1980 through 2006. We had to meticulously trace each occupation through coding and occupational name changes from 2000 back to 1980 and then from 2000 up through 2006. We relied on multiple sources of information including a military occupational coding expert at DMDC, and MOS tables referred to as Conversion Tables provided by DMDC. The conversion tables we were forced to rely on were not designed to convert occupations over time, but rather to document years in which a certain MOS code was assigned to a certain occupation. Identification of coding changes and MOS titles thus required a very complex series of research, programming and data checks to identify the proper related MOS codes over a 27 year period and link them together. While time consuming, this task was necessary in order for us to explore injury and other health outcomes associated with different job demands for a large population of enlisted Soldiers over time. Tables 5-17, Figure 1 and all related text describe the cross-walked population over this 27 year period.

### **Association between Job Demands and Injury and Other Health Outcomes**

We explored frequencies of hospitalizations for injury, hospitalizations for musculoskeletal-related conditions, and any-cause hospitalization among the most common MOS codes for enlisted U.S. Army Soldiers, stratified on the MOS's job

demands. Initial analyses focused just on Soldiers on active duty in 2000. Since a Soldier's military occupation can change during a year, hospitalization rates are provided using hospital events experienced within one year of a Soldier's qualifying personnel file. Mantel Haenszel Chi square analysis was used to identify significant differences in injury hospitalizations between light, moderate and heavy physically demanding occupations. Odds ratios (ORs) and 95% confidence intervals are reported.

Frequencies and percentages of Soldiers in 45 occupational groups of interest for the years 1980-2006 were reported in which calculation of a percentage was possible. Unadjusted annual hospitalization injury rates within the top 45 occupations are reported by year, stratified by light, moderate and heavy job demands. A summary graph was constructed by calculating the average annual rates for injury hospitalizations, musculoskeletal hospitalizations, and any hospitalizations over the entire 27-year study period for each of the three physical demand levels.

Analyses for this research were performed with SAS, Version 9 (SAS Institute, Cary, NC). All analyses for this project adhere to the policies for the protection of human subjects, as prescribed in Army Regulation 70-25, and with the provisions of 45 CFR 46.

## **RESULTS**

Table 1 shows the identified 45 most common physically demanding MOSs among enlisted Army Soldiers in 2000, stratified by heavy, moderate and light demands. There were 300,356 Soldiers with one of the top 45 most common MOS codes in the year 2000: 247,236 (82.31%) were male, and 53,116 (17.68%) were female (less than 1% were of unknown gender (N=4)). The most common occupations were Infantrymen (11B) (Heavy Demands) (6.67%), Medical Specialist (91B) (Moderate Demands) (3.90%), and Military Police (95B) (Moderate Demands) (3.36%). The top 15 heavy physical demand occupations comprised 39.87% of the entire 2000 Army population; the top 15 moderate occupations comprised 16.87%, and the top 15 light occupations made up 7.2% of the entire active-duty Army population in 2000.

Nine of the 45 jobs identified were only open to male Soldiers (20%): seven within the heavy job demands list, one within the moderate and one within the light job demands MOS list. While men were more likely to be in the heavy demands jobs than women, there were some female Soldiers (12.1%) in the heavy demands group. Of the 187,110 Soldiers who comprised the top 15 heavy MOS codes in 2000, 87.90% were male and 12.10% were female. There were 79,078 Soldiers in the top 15 moderate MOS codes: 76.80% males and 23.20% females. Of the 34,168 Soldiers classified in the top 15 light MOS, 64.51% were male and 35.49% were female.

The average age for Soldiers in the top 45 MOS codes was 27.06 years ( $\pm$  6.64) (41, 0.01%, were missing an age value). Soldiers in the top 15 heavy MOS codes had a mean age of 26.79 ( $\pm$  6.51) with very little differentiation between males and females: 26.87 ( $\pm$  6.51) for males, and 26.16 ( $\pm$  6.45) for females. The mean age for the overall

moderate physical demand group was 27.35 ( $\pm$  6.70); 27.62 ( $\pm$  6.70) for males and 26.48 ( $\pm$  6.64) for females. Among Soldiers in the light physical demand group, overall mean age was 27.85 ( $\pm$  7.08); 27.98 ( $\pm$  7.02) for males and 27.62 ( $\pm$  7.17) for females.

Table 1. Crosswalk of Military Occupational Specialties with Level of Physical Demand, 2000 (N=469,292 Total Population).

Military Occupational Specialty	Frequency (2000)	Percent of Total <sup>a</sup> (2000)	Male in MOS N (%)	Female in MOS N (%)	Mean Age (Years $\pm$ SD)	Mean Age Males (Years $\pm$ SD)	Mean Age Females (Years $\pm$ SD)
<i>Heavy Demands Jobs</i>					26.79( $\pm$ 6.51)	26.87( $\pm$ 6.51)	26.16( $\pm$ 6.45)
11B Infantryman <sup>b</sup>	31,299	6.67%	31,274 (99.92%)	25 (0.08%)	26.27( $\pm$ 6.33)	26.26( $\pm$ 6.33)	32.93( $\pm$ 7.55)
11M Fighting Vehicle Infantryman <sup>b</sup>	15,053	3.21%	15,044 (99.94%)	9 (0.06%)	26.47( $\pm$ 6.41)	26.47( $\pm$ 6.41)	35.93( $\pm$ 5.93)
92A Automated Logistical Specialist	14,932	3.18%	9,143 (61.23%)	5,789 (38.77%)	27.30( $\pm$ 6.66)	28.11( $\pm$ 6.78)	26.03( $\pm$ 6.24)
92Y Unit Supply Specialist	14,781	3.15%	9,801 (66.31%)	4,980 (33.69%)	28.01( $\pm$ 7.29)	28.82( $\pm$ 7.33)	26.44( $\pm$ 6.95)
88M Motor Transport Operator	13,530	2.88%	10,652 (78.73%)	2,877 (21.26%)	27.37( $\pm$ 6.38)	27.79( $\pm$ 6.43)	25.81( $\pm$ 5.92)
19K M1 Armor Crewman <sup>b</sup>	12,476	2.66%	12,473 (99.98%)	3 (0.02%)	26.96( $\pm$ 6.37)	26.96( $\pm$ 6.37)	26.54( $\pm$ 3.38)
63B Light-wheel Vehicle Mechanic	12,608	2.69%	11,449 (90.80%)	1,158 (9.18%)	26.92( $\pm$ 6.61)	26.96( $\pm$ 6.64)	26.46( $\pm$ 6.29)
13B Cannon Crewmember <sup>b</sup>	11,500	2.45%	11,497 (99.97%)	3 (0.03%)	26.82( $\pm$ 6.33)	26.82( $\pm$ 6.33)	31.43( $\pm$ 4.48)
12B Combat Engineer <sup>b</sup>	11,393	2.43%	11,385 (99.93%)	8 (0.07%)	25.85( $\pm$ 6.16)	25.85( $\pm$ 6.15)	30.13( $\pm$ 7.17)
92G Food Service Operations	11,130	2.37%	8,075 (72.55%)	3,055 (27.45%)	27.89( $\pm$ 6.94)	28.11( $\pm$ 6.91)	27.32( $\pm$ 6.98)
77F Petroleum Supply Specialist	9,286	1.98%	6,919 (74.51%)	2,367 (25.49%)	26.35( $\pm$ 5.90)	26.60( $\pm$ 5.98)	25.62( $\pm$ 5.60)
19D Cavalry Scout <sup>b</sup>	8,831	1.88%	8,829 (99.98%)	2 (0.02%)	25.73( $\pm$ 6.16)	25.73( $\pm$ 6.16)	34.37( $\pm$ 2.07)
54B Chemical Operations Specialist	7,382	1.57%	5,892 (79.82%)	1,490 (20.18%)	27.84( $\pm$ 7.44)	28.46( $\pm$ 7.42)	25.39( $\pm$ 7.01)
31R Multichannel Transmission System Operator/Maintainer	7,326	1.56%	6,453 (88.08%)	873 (11.92%)	25.38( $\pm$ 5.23)	25.39( $\pm$ 5.19)	25.28( $\pm$ 5.47)
11C Indirect Fire Infantrymen <sup>b</sup>	5,583	1.19%	5,579 (99.93%)	4 (0.07%)	26.42 ( $\pm$ 6.18)	26.42( $\pm$ 6.18)	37.55( $\pm$ 4.92)
<i>Moderate Demands Jobs</i>					27.35( $\pm$ 6.70)	27.62( $\pm$ 6.70)	26.48( $\pm$ 6.64)
91B Medical Specialist	18,285	3.90%	12,614 (68.99%)	5,671 (31.01%)	27.28( $\pm$ 6.49)	28.04( $\pm$ 6.53)	25.59( $\pm$ 6.06)
95B Military Police	15,755	3.36%	13,218 (83.90%)	2,537 (16.10%)	27.03( $\pm$ 6.45)	27.45( $\pm$ 6.51)	24.87( $\pm$ 5.70)
31U Signal Support Systems Specialist	9,239	1.97%	8,221 (88.98%)	1,018 (11.02%)	26.38( $\pm$ 6.42)	26.56( $\pm$ 6.49)	24.93( $\pm$ 5.68)
75H Personnel Services Specialist	8,679	1.85%	5,321 (61.31%)	3,358 (38.69%)	30.63( $\pm$ 7.70)	31.10( $\pm$ 7.72)	29.89( $\pm$ 7.61)
75B Personnel Administration Assistant	4,218	0.90%	2,590 (61.40%)	1,627 (38.57%)	25.02( $\pm$ 5.00)	25.39( $\pm$ 4.95)	24.44( $\pm$ 5.02)
13M Multiple Rocket Launch System Crewmember <sup>b</sup>	3,408	0.73%	3,407 (99.97%)	1 (0.03%)	27.28( $\pm$ 6.79)	27.28( $\pm$ 6.79)	36.41 --
14T PATRIOT Launching Station Enhanced Operator/Maintainer	2,711	0.58%	2,196 (81.00%)	515 (19.00%)	25.66( $\pm$ 5.81)	26.03( $\pm$ 5.91)	24.06( $\pm$ 5.03)
98C Signals Intelligence Analyst	2,446	0.52%	1,846 (75.47%)	599 (24.49%)	27.86( $\pm$ 6.79)	28.17( $\pm$ 6.74)	26.91( $\pm$ 6.89)

Table 1 Continued.

Military Occupational Specialty	Frequency (2000)	Percent of Total <sup>a</sup> (2000)	Male in MOS N (%)	Female in MOS N (%)	Mean Age (Years $\pm$ SD)	Mean Age Males (Years $\pm$ SD)	Mean Age Females (Years $\pm$ SD)
74C Telecommunications Operator-Maintainer	2,246	0.48%	1,497 (66.65%)	749 (33.35%)	27.90( $\pm$ 6.82)	28.06( $\pm$ 6.69)	27.60( $\pm$ 7.05)
31S Satellite Communications Systems Operator-Maintainer	2,188	0.47%	2,034 (92.96%)	154 (7.04%)	26.78( $\pm$ 6.05)	26.84( $\pm$ 6.08)	25.93( $\pm$ 5.72)
91K Medical Laboratory Specialist	2,091	0.45%	1,201 (57.44%)	890 (42.56%)	29.31( $\pm$ 6.90)	30.10( $\pm$ 7.03)	28.23( $\pm$ 6.57)
67R AH-64 Attack Helicopter Repairer	2,110	0.45%	1,968 (93.27%)	142 (6.73%)	26.49( $\pm$ 6.03)	26.58( $\pm$ 6.09)	25.13( $\pm$ 4.90)
35E Radio and Communications Security Repairer	2,031	0.43%	1,796 (88.43%)	235 (11.57%)	26.10( $\pm$ 5.87)	26.26( $\pm$ 5.91)	24.82( $\pm$ 5.36)
88N Transportation Management Coordinator	1,929	0.41%	1,295 (67.13%)	634 (32.87%)	27.72( $\pm$ 6.86)	27.32( $\pm$ 6.64)	28.53( $\pm$ 7.21)
31P Microwave Systems Operator-Maintainer	1,742	0.37%	1,524 (87.49%)	218 (12.51%)	27.33( $\pm$ 7.38)	27.03( $\pm$ 7.23)	26.40( $\pm$ 8.08)
<i>Light Demands Jobs</i>					27.85( $\pm$ 7.08)	27.98( $\pm$ 7.02)	27.62( $\pm$ 7.17)
71L Administrative Specialist	11,341	2.42%	5,472 (48.25%)	5,869 (51.75%)	28.50( $\pm$ 7.19)	28.46( $\pm$ 7.16)	28.54( $\pm$ 7.22)
96B Intelligence Analyst	4,378	0.93%	3,471 (79.28%)	907 (20.72%)	26.53( $\pm$ 6.84)	26.91( $\pm$ 6.78)	25.07( $\pm$ 6.88)
73C Finance Specialist	2,220	0.47%	1,258 (56.67%)	962 (43.33%)	28.40( $\pm$ 7.17)	29.14( $\pm$ 7.17)	27.44( $\pm$ 7.05)
93P Aviation Operations Specialist	2,127	0.45%	1,467 (68.97%)	660 (31.03%)	27.79( $\pm$ 7.49)	28.59( $\pm$ 7.57)	26.02( $\pm$ 7.00)
71D Legal Specialist	1,828	0.39%	1,111 (60.78%)	717 (39.22%)	28.70( $\pm$ 7.24)	28.73( $\pm$ 7.16)	28.66( $\pm$ 7.36)
97B Counterintelligence Agent	1,714	0.37%	1,371 (79.99%)	343 (20.01%)	27.32( $\pm$ 6.51)	27.58( $\pm$ 6.61)	26.28( $\pm$ 5.98)
76J Medical Supply Specialist	1,628	0.35%	939 (57.68%)	689 (42.32%)	28.37( $\pm$ 7.02)	29.10( $\pm$ 6.86)	27.38( $\pm$ 7.11)
14R BRADLEY Linebacker Crewmember <sup>b</sup>	1,411	0.30%	1,407 (99.72%)	4 (0.28%)	26.81( $\pm$ 6.48)	26.79( $\pm$ 6.45)	33.58( $\pm$ 11.06)
14E PATRIOT Fire Control Enhanced Operator Maintainer	1,360	0.29%	1,256 (92.35%)	104 (7.35%)	27.38( $\pm$ 6.70)	27.53( $\pm$ 6.66)	25.58( $\pm$ 6.50)
91D Operating Room Specialist	1,245	0.27%	736 (61.04%)	509 (40.88%)	27.85( $\pm$ 6.34)	28.58( $\pm$ 6.15)	26.79( $\pm$ 6.46)
33W Electronic Warfare / Intercept Systems Repairer	1,184	0.25%	1,081 (91.30%)	103 (8.70%)	26.04( $\pm$ 6.96)	26.23( $\pm$ 7.08)	24.12( $\pm$ 5.29)
96D Imagery Analyst	1,053	0.22%	786 (74.64%)	267 (25.36%)	26.23( $\pm$ 7.11)	26.63( $\pm$ 7.22)	25.06( $\pm$ 6.63)
71G Patient Administration Specialist	1,049	0.22%	555 (52.91%)	494 (47.09%)	28.06( $\pm$ 7.27)	29.08( $\pm$ 7.09)	26.91( $\pm$ 7.31)
97E Human Intelligence Collector	871	0.19%	626 (71.87%)	245 (28.13%)	28.89( $\pm$ 6.71)	29.33( $\pm$ 6.65)	27.42( $\pm$ 6.73)
91S Preventive Medicine Specialist	759	0.16%	507 (66.80%)	252 (33.20%)	28.72( $\pm$ 7.10)	29.22( $\pm$ 7.06)	27.72( $\pm$ 7.10)

<sup>a</sup> Denominator represents total population for the Army in 2000 (N=469,292).

<sup>b</sup> Occupation restricted to males only.

## HOSPITALIZATION RISK BY MOS PHYSICAL DEMAND LEVELS

This portion of the report describes hospitalizations for injuries, musculoskeletal conditions, and any-cause among Soldiers identified in the top 45 most common military occupations by levels of physical demand during the year 2000. All Soldiers on active duty in the year 2000 who held one of the top 45 (15 heavy, 15 moderate and 15 light) MOS job codes were included in the analysis (N=305,708).

Of all Soldiers identified in the year 2000 in our top 45 MOS categories, 4.95% (N=15,121) experienced a hospitalization during the 1 year follow-up time period. Just under 1% (0.87% (N=2,669)) experienced an injury hospitalization and less than 0.69% (N=2,098) experienced a hospitalization with a “Musculoskeletal System/Connective Tissue Disease” diagnosis.

Tables 2-4 (below) compare the frequencies of hospitalizations experienced across the three levels of physical demand. There are *decreasing* odds of overall hospitalization as physical demand increases (Chi-square for linear trend = 237,  $p < .0001$ ). Compared to heavy physical demand, Soldiers in light or moderate physically demanding jobs were more likely to experience a hospitalization within 1 year of holding that occupation (OR= 1.40 (95% CI=1.35-1.48 and 1.20; 95%CI=1.16-1.25, respectively). If moderate and light groups are combined, Soldiers in a heavy occupation are 0.79 (95% CI = 0.76-0.82) times less likely than all other groups to experience a hospitalization (Table 2).

Table 2. MOS Physical Demand Levels (2000) and Hospitalizations Experienced within 1 Year (Any Reason).

	MOS Physical Demand Levels			
	Heavy N=190,618 (Row %) (Column %)	Moderate N=80,292 (Row %) (Column %)	Light N=34,798 (Row %) (Column %)	Total N=305,708 (Row %) (Column %)
Any Hospitalization within 1 year	8,612 56.95% 4.52%	4,329 28.63% 5.39%	2,180 14.42% 6.26%	15,121 -- 4.95%
No Hospitalization within 1 year	182,006 62.63% 95.48%	75,963 26.14% 94.61%	32,618 11.22% 93.74%	290,587 -- 95.05%

Chi-square = 236.91,  $p < .0001$

mHx<sup>2</sup> = 126.85,  $p < .0001$

In contrast to any-cause hospitalizations, the odds for an injury-related hospitalization *increase* with increasing levels of physical demand. Compared to the heavy-demands group, Soldiers in the moderate- or light-demands groups had lower odds of experiencing an injury-related hospitalization (OR=0.80, 95%CI = 0.73-0.88 and

OR=0.67, 95%CI=0.58-0.77, respectively). In addition, the chi-square statistic for linear trend was statistically significant (47,  $p<.0001$ ) (Table 3).

Table 3. MOS Physical Demand Levels (2000) and Hospitalizations Experienced within 1 Year (with Injury Diagnosis in the Primary Position).

	MOS Physical Demand Levels			
	Heavy N=190,618 (Row %) (Column %)	Moderate N=80,292 (Row %) (Column %)	Light N=34,798 (Row %) (Column %)	Total N=305,708 (Row %) (Column %)
Injury Hospitalization within 1 year	1,826 68.42% 0.96%	620 23.23% 0.77%	223 8.36% 0.64%	2,669 -- 0.87%
No Injury Hospitalization within 1 year	188,792 62.30% 99.04%	79,672 26.29% 99.23%	34,575 11.41% 99.36%	303,039 -- 99.23%

Chi-square = 46.99,  $p<.0001$

mHx<sup>2</sup> = 29.47,  $p<.0001$

While Soldiers in highly physically demanding jobs in 2000 appear to be at greater risk for an injury hospitalization, there were no statistically significant differences in risk for a musculoskeletal disorder hospitalization. Even though musculoskeletal disorders are often associated with injury events or long-range consequences of old injuries, the OR for musculoskeletal disorder hospitalizations among those in heavy demand jobs was 0.93 (compared to moderate and light demand jobs combined) and the 95% CI was 0.85 – 1.02 ( $p <.122$ ) (Table 4).

Table 4. MOS Physical Demand Levels (2000) and Hospitalizations Experienced within 1 Year (with Musculoskeletal Diagnosis in the Primary Position).

	MOS Physical Demand Levels			
	Heavy N=190,618 (Row %) (Column %)	Moderate N=80,292 (Row %) (Column %)	Light N=34,798 (Row %) (Column %)	Total N=305,708 (Row %) (Column %)
Musculoskeletal Hospitalization within 1 year	1,274 60.72% 0.67%	582 27.74% 0.72%	242 11.53% 0.70%	2,098 -- 0.69%
No Musculoskeletal Hospitalization within 1 year	189,344 62.36% 99.33%	79,710 26.25% 99.28%	34,556 11.38% 99.30%	303,610 -- 99.31%

Chi-square = 2.69,  $p<.2599$

mHx<sup>2</sup> = 2.67,  $p<.2631$

## TEMPORAL CROSSWALK OF 45 SELECTED MOS CODES, 1980 – 2006

This section of the report details results from the linkage of the top 45 identified MOSs in 2000 to MOSs in 1980-2006. As we expected, in tracking these MOS codes over time, we learned that some of them were not used consistently throughout the study period. We found that only 10 of the 15 heavy demands occupations, 10 of the light demands MOSs and only 6 of the moderately demanding MOS codes were populated throughout the entire study period (1980-2006).

There is little that can be done about the discontinuation of a job or the initiation of a new one that overlaps with a prior MOS code. Thus, other than take into account these changes when we calculated average frequencies for the occupation each year, no other adjustments were made. When these or similar MOS changes occurred, we calculated average frequencies and average percentages of the total population using only the years in which these codes were in use. MOSs that were affected by discontinuation or which were added in the middle or end of the study period are marked by an asterisk in Table 5 along with information regarding the years in which they were available. It is possible that these codes represent newly added occupations within the military that did not exist in prior years. It is also possible, however, that these occupations did exist, but that we have been unable to track down either their predecessors or successors in the MOS coding system because of an undocumented change in nomenclature. Our crosswalk procedures thus highlight the challenges and inherent limitations of using MOS codes for research purposes. While we are able to follow certain occupations accurately over the study period, there are likely to be code transitions that we cannot account for. As such, the reader should interpret findings with caution, noting that a sudden increase or decrease in annual frequencies of Soldiers assigned to a given MOS code may represent a real change in the proportion of Soldiers assigned to that occupation, or it may reflect either redistribution of Soldiers previously assigned to other MOSs or the collapsing of codes by the Army. While these limitations do exist, our ability to track codes over time is still an important objective and necessary in order to inform temporal research utilizing occupational cohorts.

Our research revealed that of the 45 occupations, 25 (56%) of the codes used in 2000 had different MOS designator codes throughout our study period. For example, a Petroleum Supply Specialist was assigned 77F from April 1986 to September 2003 and then assigned the MOS code 92F from September 2003 forward. In some cases, we found evidence suggesting that the conversion table guiding our assessment of MOS changes was incomplete or contained errors, typically with regard to the date when a change in occupational code was implemented. For example, while the conversion tables indicate that MOS code 76W was used from 1967 to 1993, this would have resulted in an overlap with the code that replaced it, 77F. Further analysis of annual frequencies for these codes suggested strongly that the 76W MOS code was actually phased out of use beginning in 1986 and not 1993, as indicated in the conversion table. In any case, all three codes (76W, 77F and 92F) needed to be crosswalked in order to identify Soldiers who spent time as a Petroleum Supply Specialist during the study period.



In some cases, the evolution of codes made tracking an occupational group across time quite complicated. For example, in 2000, MOS code 54B was assigned to Chemical Operations Specialist. This code was used for this occupational group from October 1987 through September 2003. However, prior to this time, the alphanumeric code “54B” had been used to denote an entirely different job: Decontamination Specialist. After September 2003, Chemical Operations Specialists were given code 74D for their military occupation to replace 54B. Yet, from 1965 to April 1995, 74D was used for an Information Systems Operator. When an MOS code was, in essence, “recycled,” as in this case, we interpreted codes using a combination of information including the dates in the conversion table and actual frequencies and population counts for the codes.

Another similar example, 71D was assigned to Legal Assistant from May 1965 through April 2001. Also, from October 2000 forward, 27D denoted Paralegal Assistant. Since 71D was phased out, we believed that Legal Assistant and Paralegal Assistant were synonymous even though the years the codes were implemented overlapped. Likewise, code 27D referred to a LANCE Missile System Repairman from January 1967 to May 1977 and then to a ROLAND Repairer from September 1981 through October 1989. A LANCE Repairer was subsequently reassigned at various times to MOS codes 27L, 27E, 94A, 35A at times under a variation of the title. A ROLAND Repairer was also assigned different MOS codes throughout our study period. In other cases, specific codes of interest were eliminated and the associated occupation was collapsed into another occupational category. For example, 11M was used to denote Fighting Vehicle Infantrymen from 1983 to 2002 when the code was then discontinued. A less common MOS code, 11H (Heavy Anti-armor Weapons Infantryman) was discontinued in September 2002. Both 11M and 11H were then collapsed into 11B (Infantrymen). Since 11M and 11B were both among our top 15 most common heavy MOS codes, we chose not to retroactively collapse them for the duration of the study period. To first identify and then resolve these discrepancies and others that are similar, the data specialist had to look at the distribution of each code over every 6-month file and then link them to the related codes over the proper time periods accordingly.

All of these examples are provided to give insight into the complexity of the task of cross-walking Army MOSs over time and to also alert the reader to the decisions that were made in order to fully utilize the information available and to avoid loss of cases. Table 5 summarizes the results from the MOS crosswalk. Percentages are given based on the relative proportion of the total enlisted Army (N=3,449,097 from 1980-2006), as well as by gender (total enlisted females throughout the study period (N=484,403 from 1980-2006) and total enlisted male population (N=2,957,338 from 1980-2006)).

Table 5. Top 15 Military Occupations for Light, Moderate and Heavy Levels of Physical Demands, 1980-2006.

Military Occupational Specialty	Physical Demands	Total Army		Males		Females	
		Average Frequency	Average Percent	Average Frequency	Average Percent	Average Frequency	Average Percent
Heavy/Very Heavy Demands Jobs							
11B Infantryman	Heavy	53,886	8.60%	53,786	9.87%	91	0.12%
13B Cannon Crewmember	Heavy	21,775	3.33%	21,747	3.81%	23	0.03
63B Light-wheel Vehicle Mechanic	Heavy	20,610	3.24%	19,123	3.43%	1,485	1.91%
92Y Unit Supply Specialist	Heavy	20,012	3.17%	15,428	2.73%	4,568	5.90%
88M Motor Transport Operator	Heavy	19,163	3.00%	16,470	2.92%	2,690	3.47%
92A Automated Logistical Specialist*1993-2006	Heavy	14,730	3.03%	9,311	2.25%	5,417	7.45%
12B Combat Engineer	Heavy	14,045	2.24%	14,028	2.57%	15	0.02%
19K M1 Armor Crewman*1982-2006	Heavy	13,151	2.31%	13,135	2.68%	14	0.02%
11M Fighting Vehicle Infantryman*1983-2002	Heavy	12,473	2.18%	12,450	2.52%	20	0.03%
19D Cavalry Scout	Heavy	11,105	1.81%	11,091	2.08%	13	0.02%
92G Food Service Operations*1995-2006	Heavy	11,071	2.33%	7,861	1.96%	3,210	4.38%
11C Indirect Fire Infantrymen	Heavy	9,234	1.44%	9,225	1.64%	7	0.01%
77F Petroleum Supply Specialist	Heavy	9,256	1.59%	7,455	1.47%	1,800	2.36%
31R Multichannel Transmission System Operator/Maintainer	Heavy	8,180	1.32%	7,099	1.33%	1,080	1.36%
54B Chemical Operations Specialist*1987-2006	Heavy	8,209	1.49%	7,002	1.47%	1,204	1.61%
Moderate Demands Jobs							
95B Military Police	Moderate	23,136	3.66%	20,257	3.65%	2,885	3.70%
91B Medical Specialist*1981-2006	Moderate	18,535	3.221%	14,273	2.82%	4,258	5.63%
31U Signal Support Systems Specialist*1993-2006	Moderate	9,087	1.87%	8,056	1.95%	1,029	1.42%
75H Personnel Services Specialist*1996-2003	Moderate	7,233	1.54%	4,467	1.13%	2,765	3.74%
75B Personnel Administration Assistant	Moderate	7,167	1.19%	5,000	0.94%	2,165	2.83%
98C Signals Intelligence Analyst	Moderate	3,104	0.51%	2,327	0.45%	777	0.99%
13M Multiple Rocket Launch System Crewmember*1982-2006	Moderate	3,232	0.59%	3,229	0.69%	2.3	0.00%
14T PATRIOT Launching Station Enhanced Operator/Maintainer*1997-2006	Moderate	2,730	0.58%	2,189	0.55%	540	0.73%
74C Telecommunications Operator-Maintainer*1995-2006	Moderate	2,310	0.48%	1,515	0.37%	794	1.09%
91K Medical Laboratory Specialist	Moderate	2,552	0.42%	1,542	0.29%	1,010	1.30%

Table 5 Continued.

Military Occupational Specialty	Physical Demands	Total Army		Males		Females	
		Average Frequency	Average Percent	Average Frequency	Average Percent	Average Frequency	Average Percent
Heavy/Very Heavy Demands Jobs	Moderate	1,994	0.37%	1,347	0.29%	647	0.85%
31S Satellite Communications Systems Operator-Maintainer	Moderate	1,750	0.32%	1,634	0.35%	116	0.15%
31P Microwave Systems Operator-Maintainer*1986-2006	Moderate	1,529	0.29%	1,436	0.30%	161	0.22%
67R AH-64 Attack Helicopter Repairer*1985-2006	Moderate	1,789	0.34%	1,684	0.37%	105	0.14%
Light/Medium Demands Jobs							
71L Administrative Specialist	Light	19,209	2.92%	11,062	1.88%	8,135	10.26%
96B Intelligence Analyst	Light	3,891	0.68%	3,150	0.63%	740	0.96%
73C Finance Specialist	Light	3,548	0.56%	2,327	0.41%	1,219	1.55%
71D Legal Specialist	Light	2,080	0.34%	1,403	0.26%	676	0.87%
93P Aviation Operations Specialist*1984-2003	Light	2,147	0.39%	1,544	0.32%	603	0.79%
76J Medical Supply Specialist* 1980-2002/2004-2006	Light	1,905	0.31%	1,239	0.23%	666	0.86%
91D Operating Room Specialist	Light	1,709	0.27%	1,132	0.20%	577	0.74%
71G Patient Administration Specialist	Light	1,507	0.24%	915	0.16%	592	0.75%
97B Counterintelligence Agent	Light	1,597	0.25%	1,317	0.26%	280	0.37%
14E PATRIOT Fire Control Enhanced Operator Maintainer*1997-2003	Light	1,425	0.30%	1,300	0.33%	125	0.17%
14R BRADLEY Linebacker Crewmember*1992-2003	Light	1,308	0.27%	1305	0.32%	3	0.00%
33W Electronic Warfare/Intercept Systems Repairer*1999-2003	Light	1,327	0.28%	1221	0.30%	106	0.14%
97E Human Intelligence Collector	Light	1,270	0.22%	945	0.19%	325	0.42%
96D Imagery Analyst	Light	934	0.16%	705	0.14%	229	0.30%
91S Preventive Medicine Specialist	Light	830	0.14%	539	0.10%	291	0.37%

\* Indicates the years this specific code was used, if not used for entire study period.

## **HOSPITALIZATIONS BY JOB DEMANDS, TOP 45 JOBS, 1980 – 2006**

Once exposures to varying job demands across years (1980-2006) were assessed, the next step was to link these exposures to health outcomes. Tables 6-14 below report annual unadjusted hospitalization rates for each of the selected 45 MOSs, stratified by year (1980-2006) and job demands. In some cases, temporal patterns in the MOS did not allow for the calculation of a rate (as noted in the table).

### **Heavy Physical Demands**

As with the data from just the year 2000 sample, Soldiers in heavy physically demanding occupations experienced higher injury-related hospitalizations than those in light and moderately demanding jobs. Infantrymen generally had slightly higher rates of injury hospitalizations throughout the study period (1938 per 100,000 11B population) than did all other heavy physical demand occupations. Within the heavy demands occupations, musculoskeletal disorder hospitalization rates increased steadily until 1996 when there was a dramatic decrease in rates. Again, Infantrymen (11B) had the highest rates of musculoskeletal-related hospitalizations (total annual average rate per 100,000 11B population = 1,222) with Chemical Operations Specialists (54B) having the next highest average annual rate of musculoskeletal hospitalizations (1,213 per 100,000 54B population) compared to other heavy occupations. Petroleum Supply Specialists (77F) and Unit Supply Specialists (92Y) generally had higher rates of experiencing any hospitalization compared to other heavy physical demand occupations (average annual rates=10,319 per 100,000 77F population and 10,223 per 100,000 92Y population).

### **Moderate Physical Demands**

For Soldiers with moderately physically demanding jobs, Multiple Rocket Launch System Crewmembers (13M) had higher rates of injury hospitalizations than other moderate demands MOSs throughout most of the study period, particularly in the early 1990s and from 2002 forward. On the whole, rates of musculoskeletal hospitalizations among the moderate physical demands group mirrored patterns within the heavy physical demands group – steadily increasing until 1996, and then a relatively sharp decline. From 1980-1991, Medical Specialists (91B) had the highest rates of musculoskeletal hospitalizations with a rate of 1,715 per 100,000 91B population for that 12 year period. Overall hospitalization rates for Medical laboratory Specialists (91K) were higher, on average, than other moderate demand MOSs throughout the study period (13,173 per 100,000 91K population) and were particularly higher than other moderate occupations from 1981-1996.

### **Light Physical Demands**

Within light physical demand occupations, Human Intelligence Collectors (97E) had much higher rates of injury hospitalizations throughout the entire study period than other light demands jobs, with an average annual rate of 9,154 per 100,000 97E

population compared to a combined average annual rate for all other light physical demanding occupations of 841 per 100,000 MOS population. Operating Room Specialists (91D) and Patient Administration Specialists (71G) had higher rates of musculoskeletal hospitalizations, as well as higher rates of hospitalizations overall (all-cause) compared to the rest of the light occupations.

Table 6. Rates of Injury Hospitalizations for Top 15 Heavy MOS Codes, 1980-2006.

Year	Rate 11B Injury Hospitalizations per MOS pop	Rate 11C Injury Hospitalizations per MOS pop	Rate 11M Injury Hospitalizations per MOS pop	Rate 12B Injury Hospitalizations per MOS pop	Rate 13B Injury Hospitalizations per MOS pop	Rate 19D Injury Hospitalizations per MOS pop	Rate 19K Injury Hospitalizations per MOS pop	Rate 31R Injury Hospitalizations per MOS pop	Rate 54B Injury Hospitalizations per MOS pop	Rate 63B Injury Hospitalizations per MOS pop	Rate 77F Injury Hospitalizations per MOS pop	Rate 88M Injury Hospitalizations per MOS pop	Rate 92A Injury Hospitalizations per MOS pop	Rate 92G Injury Hospitalizations per MOS pop	Rate 92Y Injury Hospitalizations per MOS pop
1980	1493.88	1373.22	-	1396.49	1147.75	1293.79	-	1043.65	-	1062.81	935.55	910.05	-	-	860.66
1981	2991.68	2663.09	-	2529.04	2270.88	2789.84	-	1961.17	-	1990.87	1840.49	2250.59	-	-	1414.80
1982	2782.69	2488.70	-	2789.12	2186.97	2518.59	1645.06	1525.34	-	1989.47	1352.51	2034.20	-	-	1724.01
1983	2395.02	2094.42	1122.99	2369.06	2285.38	2128.61	1745.95	1960.22	-	1701.13	1489.91	2059.03	-	-	1406.90
1984	2422.47	2570.16	1923.08	2221.98	2285.66	2378.76	2143.21	1802.91	-	1732.66	1873.54	1870.88	-	-	1420.28
1985	2601.84	2495.99	1835.82	2632.91	2233.31	2235.38	2065.01	1487.66	-	1836.62	2046.20	1935.87	-	-	1285.05
1986	2380.99	2175.78	2173.23	2187.52	2050.93	2000.61	1854.93	1629.76	-	1872.70	1644.85	2000.22	-	-	1371.27
1987	2473.26	1858.08	1828.95	2373.80	1988.28	1880.34	2023.32	1919.18	1071.63	1560.10	1816.98	1782.53	-	-	1339.51
1988	2410.58	2291.17	1602.30	2067.56	2069.20	1828.63	1998.48	1643.60	1452.64	1414.00	1847.33	1763.82	-	-	1435.27
1989	2761.82	2332.52	1878.79	2049.72	1902.82	1523.83	1878.23	1536.02	1585.06	1762.94	1747.30	1482.85	-	-	1135.88
1990	2510.00	2219.87	2706.19	2801.23	1975.90	2741.33	2501.15	1494.77	2101.08	1675.75	1960.60	2618.55	-	-	1408.26
1991	2232.44	1770.55	1963.93	2155.58	1792.59	1817.25	1928.68	1266.94	1670.32	1356.70	1611.13	1712.60	-	-	1126.95
1992	1708.42	1328.39	1264.12	1450.31	1333.92	1509.23	1378.68	905.12	1187.23	941.10	941.15	1045.35	-	-	866.38
1993	2007.29	1654.91	1369.22	1158.04	1632.12	1408.60	1265.67	959.05	1056.47	1077.84	1136.36	1198.51	591.72	-	932.43
1994	1595.22	1353.97	1169.92	1188.29	1425.58	1221.49	1244.32	776.20	1100.80	1073.53	1088.26	855.72	880.24	-	835.67
1995	1437.70	1206.61	1158.03	1299.62	1251.54	1017.03	1002.59	899.21	1036.61	1027.08	1077.51	1003.09	967.05	142.11	797.72
1996	1358.44	1018.62	959.52	1299.30	1148.39	1091.55	1224.26	745.98	824.46	785.96	824.56	826.77	822.91	643.30	665.30
1997	886.32	1102.94	959.33	1135.13	970.12	1088.29	954.34	860.48	724.53	710.49	881.80	668.42	689.79	682.74	593.97
1998	994.03	807.60	1114.43	940.85	864.68	855.33	1086.53	757.85	682.55	523.68	782.72	628.68	627.44	776.95	622.06
1999	1000.34	1198.66	955.37	865.43	891.70	1019.92	789.53	898.13	925.30	667.37	732.71	546.61	693.70	699.18	562.12
2000	955.47	1223.08	1250.81	1258.51	1004.56	1016.46	1092.98	747.16	615.38	713.40	701.31	946.49	608.99	850.84	573.95
2001	1244.95	874.59	1041.76	1122.25	1010.61	997.40	1068.14	559.53	669.70	742.10	555.84	771.25	671.58	859.43	603.99
2002	1088.01	933.83	605.65	930.36	1049.33	1187.35	1122.70	670.80	822.83	955.81	776.06	740.74	529.43	766.07	719.24
2003	2316.17	1902.82	-	2747.50	2139.78	2911.22	2091.75	886.75	1129.94	1137.69	1181.35	1590.96	896.98	1137.07	944.94
2004	2578.26	2151.88	-	2547.37	1957.22	2399.42	2072.10	970.62	1037.86	909.23	1339.36	1511.97	839.72	836.47	789.28
2005	2251.75	1825.07	-	2348.18	1634.36	1613.16	2793.01	1007.13	847.46	794.17	761.87	1118.19	767.14	675.30	553.67
2006	1458.52	1382.93	-	1590.39	985.99	1841.88	1236.05	499.81	469.17	498.60	420.59	563.30	407.03	395.87	343.74

Table 7. Rates of Musculoskeletal Hospitalizations for Top 15 Heavy MOS Codes, 1980-2006.

Year	Rate 11B Musculoskeletal Hosps. per MOS pop	Rate 11C Musculoskeletal Hosps. per MOS pop	Rate 11M Musculoskeletal Hosps. per MOS pop	Rate 12B Musculoskeletal Hosps. per MOS pop	Rate 13B Musculoskeletal Hosps. per MOS pop	Rate 19D Musculoskeletal Hosps. per MOS pop	Rate 19K Musculoskeletal Hosps. per MOS pop	Rate 31R Musculoskeletal Hosps. per MOS pop	Rate 54B Musculoskeletal Hosps. per MOS pop	Rate 63B Musculoskeletal Hosps. per MOS pop	Rate 77F Musculoskeletal Hosp per MOS pop	Rate 88M Musculoskeletal Hosps. per MOS pop	Rate 92A Musculoskeletal Hosps. per MOS pop	Rate 92G Musculoskeletal Hosps. per MOS pop	Rate 92Y Musculoskeletal Hosps. per MOS pop
1980	632.46	543.32	-	515.87	591.27	437.90	-	551.93	-	499.59	571.73	560.03	-	-	556.46
1981	1217.00	896.42	-	900.90	950.99	882.50	-	985.51	-	1075.07	1208.95	1255.98	-	-	1108.61
1982	1162.28	1079.11	-	1150.79	867.80	964.72	1096.71	682.14	-	1168.53	992.98	1186.32	-	-	1093.45
1983	1267.54	1104.45	588.24	1069.90	984.28	814.10	860.32	956.21	-	1200.60	1041.33	1148.02	-	-	1204.39
1984	1468.84	1342.28	1012.15	1370.77	940.97	1158.69	1013.46	849.54	-	1265.39	1068.50	1099.46	-	-	1017.18
1985	1384.39	1265.82	1281.61	1161.41	1049.82	1028.12	1039.17	816.40	-	1272.36	1135.31	1181.45	-	-	1268.93
1986	1600.98	1336.01	1328.96	1353.10	1194.46	1282.83	1093.43	880.73	-	1470.87	883.97	1246.98	-	-	1221.53
1987	1672.08	1221.02	1171.05	1293.75	1120.43	1196.58	1218.50	1355.75	676.82	1560.10	1176.80	1347.26	-	-	1382.72
1988	1811.86	1417.49	1166.99	1562.69	1174.33	1689.31	1211.78	1412.92	1371.94	1583.34	1237.36	1426.55	-	-	1410.38
1989	1843.36	1726.79	1272.73	1722.46	1397.59	1304.93	1430.48	1631.36	1924.71	1576.47	1703.40	1430.20	-	-	1532.81
1990	2045.57	1556.79	1314.94	1599.11	1434.96	1153.36	1465.84	1956.79	2285.05	2019.84	1719.01	2223.39	-	-	1685.37
1991	2136.63	1667.01	1283.47	1743.21	1514.61	1475.98	1370.00	1355.33	2129.66	2061.61	1721.20	1680.49	-	-	1728.30
1992	1895.71	1412.16	1179.84	1635.15	1373.86	1447.09	1485.97	1680.94	1786.30	1516.48	1447.93	1657.96	-	-	1554.53
1993	1936.28	1231.56	1580.77	1473.09	1512.95	1629.35	1737.19	1477.45	1894.35	1800.10	1680.87	1701.34	913.53	-	1494.13
1994	1905.48	1851.34	1442.90	1632.69	1664.15	1729.54	1448.42	1649.42	2053.18	2035.37	1494.86	1815.61	1307.96	-	1572.00
1995	2012.79	1996.13	1757.22	1827.60	1456.23	1394.13	1462.89	1348.82	2375.02	2256.97	1530.55	1840.26	1786.26	757.93	1842.36
1996	1730.29	1416.52	1571.21	1473.14	1507.67	1126.76	1460.18	1361.08	1708.89	1691.23	1226.00	1772.80	1633.07	776.40	1516.12
1997	662.38	767.26	627.49	671.99	717.05	843.73	755.52	516.29	710.33	822.68	619.36	692.29	613.14	527.18	540.58
1998	560.10	570.07	610.14	521.66	432.34	488.76	605.07	553.35	762.85	729.98	386.41	541.14	521.76	420.85	483.83
1999	518.47	495.45	483.97	649.07	388.69	450.66	547.13	590.20	489.86	488.32	340.56	443.20	390.63	409.28	498.08
2000	683.36	637.38	496.45	586.16	438.97	541.38	616.75	453.64	802.68	597.08	393.16	611.58	450.12	567.23	533.90
2001	472.22	577.56	447.77	634.72	530.57	596.27	592.55	611.58	535.76	703.85	555.84	589.35	395.05	594.99	448.32
2002	441.25	322.01	370.12	469.79	446.17	472.84	422.01	518.92	552.84	603.26	476.86	568.65	515.68	442.27	485.80
2003	496.46	543.66	-	495.45	552.20	452.63	594.25	494.05	454.43	670.15	532.06	840.09	441.70	618.81	492.16
2004	503.34	586.88	-	543.92	627.63	456.16	616.24	432.84	672.25	588.93	513.13	818.98	559.81	606.25	563.77
2005	612.44	435.21	-	593.79	608.54	608.89	813.91	480.32	670.90	637.36	664.42	565.60	648.58	635.10	588.28
2006	317.41	262.76	-	282.74	354.61	296.57	396.64	461.36	402.14	329.17	143.00	379.25	407.03	370.05	350.61

Table 8. Rates of Any Hospitalizations for Top 15 Heavy MOS Codes, 1980-2006.

Year	Rate 11B Any Hospitalization per MOS pop	Rate 11C Any Hospitalization per MOS pop	Rate 11M Any Hospitalization per MOS pop	Rate 12B Any Hospitalization per MOS pop	Rate 13B Any Hospitalization per MOS pop	Rate 19D Any Hospitalization per MOS pop	Rate 19K Any Hospitalization per MOS pop	Rate 31R Any Hospitalization per MOS pop	Rate 54B Any Hospitalization per MOS pop	Rate 63B Any Hospitalization per MOS pop	Rate 77F Any Hospitalization per MOS pop	Rate 88M Any Hospitalization per MOS pop	Rate 92A Any Hospitalization per MOS pop	Rate 92G Any Hospitalization per MOS pop	Rate 92Y Any Hospitalization per MOS pop
1980	6527.02	5839.15	-	6768.80	5286.62	6210.19	-	6532.87	-	5972.76	7830.91	6730.84	-	-	6536.58
1981	10518.94	9376.43	-	10072.72	8782.32	9358.76	-	10387.31	-	9194.77	12811.26	11846.97	-	-	10797.49
1982	9905.93	9105.01	-	9886.62	8757.43	8940.28	7178.46	10165.80	-	9543.51	12104.09	10331.31	-	-	12042.57
1983	9100.24	8216.04	4652.41	8700.25	9255.33	8805.74	7793.52	10174.03	-	8917.82	11326.50	10376.62	-	-	11063.35
1984	9495.82	9205.31	6452.43	9468.27	8735.73	8977.90	6778.53	9807.44	-	8891.84	11241.22	9725.68	-	-	10981.77
1985	9763.16	8744.87	7083.48	9178.55	8444.18	8949.30	6554.76	9715.17	-	9522.40	11696.37	10188.25	-	-	11118.27
1986	10018.59	9380.67	8864.92	10537.29	9066.75	9445.63	7693.06	11235.49	-	10728.23	11838.42	11269.69	-	-	11904.01
1987	10366.32	9246.15	8552.63	11187.48	9173.93	9179.49	8597.22	12580.33	7858.62	10504.41	13424.97	11304.56	-	-	12754.84
1988	10606.25	9654.99	7400.20	9712.71	9334.97	9613.38	8958.25	11716.65	10622.42	11108.76	13375.74	11590.17	-	-	12635.33
1989	10966.55	9872.53	8515.15	10903.14	9904.53	9378.68	8786.42	12351.69	13539.01	11704.88	14575.47	11827.67	-	-	13208.34
1990	11515.05	9753.99	10507.78	11764.05	10239.05	9644.80	9922.61	13860.58	13942.68	12570.38	15749.86	16263.57	-	-	15399.99
1991	11194.79	9008.08	8431.07	10652.92	9379.90	8574.35	8730.08	11063.64	12725.75	11336.42	13449.41	14166.44	-	-	14517.73
1992	9349.51	7467.69	6725.10	9028.86	8418.87	8132.10	8400.84	9988.69	11970.37	9703.53	11873.00	11476.42	-	-	12347.15
1993	9432.85	7722.90	7739.32	8148.84	9305.70	8062.65	8177.19	11067.91	10856.10	10083.89	12488.16	11819.81	8169.83	-	11992.36
1994	9007.70	7723.13	7660.17	8008.89	8501.11	7945.09	7288.17	11448.90	10303.03	10363.02	12676.39	11355.01	12093.97	-	11226.04
1995	8109.77	7582.30	7973.73	8559.24	7754.84	6810.65	7453.18	9010.87	10457.95	9976.45	12085.22	11222.57	13341.55	7200.38	11845.52
1996	7299.01	5952.57	6230.88	8015.37	7326.62	6032.86	6484.73	7891.64	9368.91	8835.09	9601.82	10406.23	12694.56	8573.65	10030.71
1997	3867.02	4156.01	5068.18	4785.69	4506.15	4658.84	4161.97	6293.79	5682.63	5706.38	8398.07	6692.13	9337.68	8339.82	7474.64
1998	3603.74	3737.13	4675.63	4136.00	3458.71	3885.63	4007.81	5774.09	6089.40	5054.35	8382.05	5833.20	8480.29	7745.22	7444.01
1999	3723.81	3979.54	4098.05	4335.79	3711.61	4305.03	3933.79	6530.66	6477.07	4826.24	7647.06	6071.80	8324.35	8023.53	7513.88
2000	3784.79	4237.73	4480.98	5025.43	4052.00	4607.23	4777.89	5390.26	6354.52	4807.69	6991.82	7331.63	8618.52	8348.84	7014.15
2001	4035.35	4174.92	4806.73	5050.13	4101.40	4520.82	4787.15	5283.02	6710.42	5034.04	6710.46	6264.55	9020.28	7875.38	7546.70
2002	4241.22	4347.13	3398.38	4661.02	4643.48	4591.78	5223.35	5758.76	6595.53	5625.20	7255.73	7205.39	9907.87	9161.27	8656.15
2003	5972.77	5317.70	-	6287.72	6091.46	6820.29	6465.41	6004.56	6963.89	5758.59	7962.85	8742.84	9119.33	9823.64	9442.88
2004	6146.91	6206.65	-	6527.06	5764.31	6368.03	6316.44	6400.84	6179.97	4272.36	7244.74	7776.84	8383.87	8617.91	8005.57
2005	6261.96	5110.21	-	6414.75	5546.38	6468.45	7753.60	5608.92	6756.12	5275.94	6599.93	7346.25	9045.26	8987.86	8360.44
2006	3637.58	3512.65	-	3984.80	3528.80	4542.26	3855.73	3114.19	3675.16	2991.58	3272.21	3736.75	5048.56	4302.93	4166.09



Table 9. Rates of Injury Hospitalizations for Top 15 Moderate MOS Codes, 1980-2006.

Year	Rate 13M Injury Hospitalization per MOS pop	Rate 14T Injury Hospitalization per MOS pop	Rate 31P Injury Hospitalization per MOS pop	Rate 31S Injury Hospitalization per MOS pop	Rate 31U Injury Hospitalization per MOS pop	Rate 35E Injury Hospitalization per MOS pop	Rate 67R Injury Hospitalization per MOS pop	Rate 74C Injury Hospitalization per MOS pop	Rate 75B Injury Hospitalization per MOS pop	Rate 75H Injury Hospitalization per MOS pop	Rate 88N Injury Hospitalization per MOS pop	Rate 91B Injury Hospitalization per MOS pop	Rate 91K Injury Hospitalization per MOS pop	Rate 95B Injury Hospitalization per MOS pop	Rate 98C Injury Hospitalization per MOS pop
1980	-	-	-	350.26	-	-	-	-	792.60	-	-	1088.79	919.46	820.37	857.84
1981	-	-	-	1044.78	-	-	-	-	1327.18	-	-	2004.43	1209.96	1817.95	1994.63
1982	-	-	-	838.32	-	-	-	-	1296.25	-	-	1810.01	1409.44	1572.79	1679.54
1983	1910.83	-	-	635.79	-	-	-	-	1374.39	-	-	1803.56	1195.76	1558.90	1340.18
1984	2163.23	-	-	1408.45	-	-	-	-	1113.35	-	-	1619.74	1387.87	1626.42	1634.08
1985	2992.35	-	-	1000.67	-	-	3555.56	-	1156.63	-	-	1606.87	1239.83	1769.94	1360.35
1986	1233.91	-	477.33	1581.84	-	-	1452.28	-	1057.93	-	-	1474.37	1101.32	1520.82	1259.60
1987	1556.42	-	560.75	775.80	-	-	1796.41	-	1139.17	-	1672.73	1360.08	1006.47	1508.00	1186.39
1988	1420.56	-	956.02	1853.34	-	-	918.27	-	980.99	-	896.46	1142.93	1067.62	1613.56	890.04
1989	1673.36	-	971.92	815.66	-	-	678.73	-	864.01	-	939.77	1245.53	1159.42	1675.23	668.21
1990	1740.93	-	1155.46	1217.39	-	-	2369.98	-	1288.24	-	1493.19	1646.47	1611.05	1581.59	1026.99
1991	1394.99	-	1200.69	370.37	-	-	1285.05	-	838.90	-	1175.41	1107.35	1009.35	1423.88	1173.88
1992	1164.45	-	636.94	903.41	-	-	838.93	-	815.22	-	805.31	991.06	905.14	978.25	686.20
1993	1717.60	-	431.30	488.83	462.11	-	1080.77	-	769.35	-	783.70	1254.33	544.27	1076.08	848.26
1994	1341.97	-	720.07	652.17	894.65	-	951.32	-	966.65	-	892.39	1093.93	476.36	991.64	902.06
1995	1555.61	-	790.68	644.78	1073.64	804.51	1251.42	443.13	742.31	-	533.33	1018.00	786.22	1002.51	426.89
1996	721.86	-	563.38	739.77	971.28	659.63	1757.28	795.91	920.81	432.25	681.43	887.07	675.14	746.07	522.00
1997	735.12	1075.27	1026.69	546.45	616.38	652.74	600.76	340.77	585.98	286.09	555.56	636.69	377.68	569.80	450.28
1998	656.90	969.83	275.79	327.73	651.69	498.41	623.05	402.82	830.52	488.28	348.63	707.67	306.61	767.52	376.22
1999	708.62	851.37	278.55	524.93	585.32	523.83	652.99	531.31	559.37	383.60	330.76	709.64	331.60	614.04	712.03
2000	767.05	1215.15	837.52	135.07	741.45	334.13	559.44	823.94	747.66	418.36	355.69	819.41	653.29	774.90	510.81
2001	993.75	824.61	398.86	300.56	676.34	376.47	820.42	557.62	928.13	395.07	545.91	731.15	535.95	697.36	737.74
2002	966.73	1030.26	561.48	276.24	754.98	1180.74	697.17	923.55	581.24	595.67	667.35	741.29	806.11	783.52	547.65
2003	1743.70	1077.73	721.15	681.56	1253.57	1088.93	1072.28	625.36	286.40	277.26	693.07	1030.37	671.42	1610.78	466.51
2004	1544.20	1074.19	461.74	404.56	1018.38	1173.02	590.41	259.40	655.42	-	762.20	1220.47	347.07	1360.15	429.65
2005	1113.79	1291.13	852.71	781.25	615.52	816.33	860.83	1044.18	712.82	-	503.89	1037.42	637.81	1501.87	553.93
2006	593.47	285.41	556.59	275.96	397.81	500.94	662.94	486.85	360.40	-	204.50	593.50	474.61	967.86	200.00

Table 10. Rates of Musculoskeletal Hospitalizations for Top 15 Moderate MOS Codes, 1980-2006.

Year	Rate 13M Musculoskeletal Hosps. per MOS pop	Rate 14T Musculoskeletal Hosps. per MOS pop	Rate 31P Musculoskeletal Hosps. per MOS pop	Rate 31S Musculoskeletal Hosps. per MOS pop	Rate 31U Musculoskeletal Hosps. per MOS pop	Rate 35E Musculoskeletal Hosps. per MOS pop	Rate 67R Musculoskeletal Hosps. per MOS pop	Rate 74C Musculoskeletal Hosps. per MOS pop	Rate 75B Musculoskeletal Hosps. per MOS pop	Rate 75H Musculoskeletal Hosps. per MOS pop	Rate 88N Musculoskeletal Hosps. per MOS pop	Rate 91B Musculoskeletal Hosps. per MOS pop	Rate 91K Musculoskeletal Hosps. per MOS pop	Rate 95B Musculoskeletal Hosps. per MOS pop	Rate 98C Musculoskeletal Hosps. per MOS pop
1980	-	-	-	350.26	-	-	-	-	396.30	-	-	772.42	514.90	501.34	245.10
1981	-	-	-	447.76	-	-	-	-	1067.51	-	-	1417.14	747.33	969.15	843.88
1982	-	-	-	598.80	-	-	-	-	850.66	-	-	1379.79	1057.08	987.56	1142.09
1983	636.94	-	-	999.09	-	-	-	-	1057.22	-	-	1498.83	1332.42	1033.62	1083.55
1984	98.33	-	-	815.42	-	-	-	-	992.62	-	-	1412.56	1351.35	1105.17	1371.46
1985	974.25	-	-	733.82	-	-	444.44	-	933.67	-	-	1749.94	1046.11	1163.29	1215.63
1986	536.48	-	0.00	1375.52	-	-	1659.75	-	1120.91	-	-	1866.63	1211.45	1233.37	1290.32
1987	1634.24	-	841.12	930.95	-	-	1946.11	-	1444.51	-	727.27	2349.22	1473.76	1415.05	1280.05
1988	1532.71	-	573.61	1047.54	-	-	642.79	-	1937.75	-	1389.51	1909.37	1672.60	1470.89	1751.36
1989	1506.02	-	971.92	1060.36	-	-	1734.54	-	1753.07	-	1537.80	2014.05	1557.97	1531.35	1542.02
1990	1091.77	-	735.29	782.61	-	-	1777.49	-	1704.24	-	2108.04	2239.20	1956.27	1690.66	1862.91
1991	1627.49	-	1715.27	1111.11	-	-	2453.27	-	1194.37	-	1989.15	1976.31	1757.01	1918.29	1393.98
1992	1782.32	-	1447.60	2084.78	-	-	1845.64	-	1830.66	-	1421.13	1641.44	1846.49	1507.26	2058.59
1993	1784.52	-	1848.43	1675.98	970.43	-	1478.95	-	1617.21	-	2351.10	2010.30	1523.95	1820.34	1665.10
1994	1341.97	-	1080.11	1449.28	1206.27	-	1510.91	-	1498.31	-	2152.23	2055.83	2088.68	1922.88	1288.66
1995	1892.66	-	1373.28	1055.10	1640.84	643.60	1763.37	1299.85	1767.41	-	2453.33	2071.11	1797.08	1951.69	1316.26
1996	1917.44	-	1361.50	1305.48	1477.58	703.61	1702.36	1108.58	1391.45	605.14	1646.79	1705.09	1389.99	1680.00	1715.14
1997	829.97	501.79	821.36	672.55	574.59	696.26	928.45	774.47	428.22	512.58	611.11	773.83	377.68	940.17	750.47
1998	707.43	826.15	275.79	286.77	393.26	634.35	830.74	369.25	415.26	542.53	1336.43	554.93	657.03	767.52	639.58
1999	538.55	780.42	278.55	481.19	461.50	733.37	419.78	341.56	533.94	526.09	551.27	553.73	663.19	633.03	356.01
2000	710.23	750.54	279.17	360.20	571.97	525.06	559.44	303.56	303.74	610.58	558.94	637.32	699.95	631.17	589.39
2001	425.89	983.19	398.86	300.56	545.43	705.88	501.37	418.22	475.96	526.76	545.91	611.03	357.30	666.50	479.53
2002	540.23	450.74	449.19	355.17	571.95	544.96	392.16	461.78	766.18	583.52	616.02	706.47	381.84	641.06	620.66
2003	498.20	653.17	600.96	302.92	461.84	680.58	516.28	568.50	304.31	0.00	396.04	632.68	335.71	630.55	299.90
2004	745.47	637.80	593.67	441.34	475.98	488.76	369.00	843.06	431.62	-	609.76	721.78	433.84	609.72	787.68
2005	752.56	832.99	465.12	603.69	681.47	932.94	717.36	562.25	491.60	-	458.09	833.41	683.37	794.76	586.51
2006	494.56	321.08	185.53	379.44	354.80	250.47	488.49	389.48	360.40	-	531.70	367.80	474.61	357.81	166.67

Table 11. Rates of Any Hospitalizations for Top 15 Moderate MOS Codes, 1980-2006.

Year	Rate 13M Any Hospitalization per MOS pop	Rate 14T Any Hospitalization per MOS pop	Rate 31P Any Hospitalization per MOS pop	Rate 31S Any Hospitalization per MOS pop	Rate 31U Any Hospitalization per MOS pop	Rate 35E Any Hospitalization per MOS pop	Rate 67R Any Hospitalization per MOS pop	Rate 74C Any Hospitalization per MOS pop	Rate 75B Any Hospitalization per MOS pop	Rate 75H Any Hospitalization per MOS pop	Rate 88N Any Hospitalization per MOS pop	Rate 91B Any Hospitalization per MOS pop	Rate 91K Any Hospitalization per MOS pop	Rate 95B Any Hospitalization per MOS pop	Rate 98C Any Hospitalization per MOS pop
1980	-	-	-	5779.33	-	-	-	-	6384.85	-	-	9597.76	7686.65	5305.06	6944.44
1981	-	-	-	9253.73	-	-	-	-	10588.57	-	-	15137.46	14982.21	9067.59	11660.91
1982	-	-	-	9580.84	-	-	-	-	10572.51	-	-	14325.03	15891.47	9137.46	10816.26
1983	10615.71	-	-	8446.87	-	-	-	-	11285.85	-	-	14913.90	14485.82	10268.40	9124.61
1984	6588.00	-	-	7412.90	-	-	-	-	10301.81	-	-	12844.90	16106.65	9742.02	11934.64
1985	10229.65	-	-	6871.25	-	-	14222.22	-	11594.20	-	-	12854.94	15691.59	9889.67	10535.46
1986	6384.12	-	4295.94	9353.51	-	-	10165.98	-	12518.89	-	-	13161.10	14977.97	10110.97	11305.68
1987	8715.95	-	7196.26	7680.37	-	-	10628.74	-	14327.66	-	9309.09	13738.15	18008.63	10838.35	11863.88
1988	8710.28	-	6978.97	9105.56	-	-	7805.33	-	13891.24	-	12998.66	13500.07	19466.19	11712.75	11053.69
1989	9672.02	-	7559.40	8075.04	-	-	8823.53	-	14237.42	-	16915.85	14999.34	20688.41	11315.52	11256.75
1990	8793.15	-	8718.49	12434.78	-	-	10928.24	-	14881.91	-	17918.31	15318.76	21020.33	12016.43	12037.26
1991	9325.76	-	10034.31	8962.96	-	-	10922.90	-	12370.25	-	15867.99	13226.70	18317.76	11450.38	11371.97
1992	8626.43	-	7064.27	8825.57	-	-	7941.83	-	11985.13	-	14542.87	12821.80	18356.26	9849.69	10504.09
1993	10394.82	-	8256.32	7611.73	6869.99	-	9442.55	-	10613.91	-	14106.58	15288.45	17271.41	10173.03	10681.75
1994	7519.67	-	7335.73	7608.70	8534.38	-	8561.84	-	11438.70	-	14068.24	13900.41	17845.36	10147.99	9246.13
1995	8478.09	-	7615.48	8206.33	9227.19	6516.49	9328.78	7444.61	10851.89	-	14080.00	13655.28	15200.30	10110.38	9178.23
1996	6451.61	-	8779.34	7267.19	8534.82	6860.16	8347.06	11512.22	10190.30	5295.01	12208.97	12376.50	14376.49	7557.30	8948.55
1997	4553.00	7096.77	6211.50	5212.27	5975.76	5221.93	5625.34	7930.61	6851.48	6246.27	10166.67	8115.39	7385.65	5213.68	5178.24
1998	3663.47	6285.92	4136.79	4711.18	4921.35	4349.80	4153.69	6747.23	7889.96	6792.53	9471.24	8140.72	7358.74	5324.70	4364.18
1999	3628.12	8052.50	5069.64	4855.64	5020.26	4662.13	5223.88	7134.72	7348.08	6882.95	6890.85	8338.26	6489.82	5652.97	4944.62
2000	4318.18	8434.60	5583.47	3511.93	4946.51	3723.15	4475.52	7285.34	7920.56	7417.46	6961.38	8419.02	7466.17	5774.28	5108.06
2001	4287.34	7928.96	5584.05	4036.07	5421.62	5411.76	3919.78	6459.11	9233.70	8188.67	8039.70	7943.39	8530.59	5659.10	4869.05
2002	4435.60	9111.40	6007.86	3946.33	5765.27	4586.74	4793.03	8876.35	9881.11	7986.87	7546.20	8467.66	7679.25	5906.10	4819.28
2003	5978.41	7968.65	5709.13	4240.82	6443.81	7395.64	5599.68	6424.10	5835.50	3696.86	8316.83	9060.92	8057.07	7360.28	4665.11
2004	5138.45	6747.23	4089.71	5296.06	5501.44	5865.10	4944.65	6809.34	7625.29	-	6656.50	8425.20	8590.02	6607.26	5119.94
2005	6261.29	8371.51	6744.19	4332.39	5913.39	4606.41	5451.94	6666.67	7791.89	-	5771.87	8633.56	8382.69	6884.06	5017.92
2006	3461.92	3032.47	2690.17	2000.69	3042.68	2567.31	2896.02	4868.55	4188.69	-	3108.38	4551.53	5363.08	3906.62	2400.00

Table 12. Rates of Injury Hospitalizations for Top 15 Light MOS Codes, 1980-2006.

Year	Rate 14E Injury Hospitalization per MOS pop	Rate 14R Injury Hospitalization per MOS pop	Rate 33W Injury Hospitalization per MOS pop	Rate 71D Injury Hospitalization per MOS pop	Rate 71G Injury Hospitalization per MOS pop	Rate 71L Injury Hospitalization per MOS pop	Rate 73C Injury Hospitalization per MOS pop	Rate 76J Injury Hospitalization per MOS pop	Rate 91D Injury Hospitalization per MOS pop	Rate 91S Injury Hospitalization per MOS pop	Rate 93P Injury Hospitalization per MOS pop	Rate 96B Injury Hospitalization per MOS pop	Rate 96D Injury Hospitalization per MOS pop	Rate 97B Injury Hospitalization per MOS pop	Rate 97E Injury Hospitalization per MOS pop
1980	-	-	-	928.79	739.96	631.75	342.40	642.40	1360.23	242.13	-	821.60	752.82	318.13	8695.65
1981	-	-	-	1116.84	1808.14	1119.18	1016.82	1252.51	1457.45	1169.59	-	1262.83	1480.48	714.92	13043.48
1982	-	-	-	1062.47	1510.57	1069.37	1272.26	1253.76	1723.31	2281.37	-	1225.40	1623.82	985.66	6172.84
1983	-	-	-	1057.08	1564.03	916.11	1041.22	1338.26	1729.11	1077.84	-	1074.90	732.06	1156.07	6122.45
1984	-	-	-	896.67	1586.43	1068.40	1168.01	1300.51	1674.64	1203.37	440.53	1176.47	287.36	764.82	13846.15
1985	-	-	-	830.06	1702.36	1073.52	1167.58	1137.49	2269.13	1566.27	828.03	1572.42	976.29	880.28	11290.32
1986	-	-	-	886.66	1291.99	917.50	1007.50	1527.07	2000.00	1831.90	1369.17	1272.57	944.51	657.41	10429.45
1987	-	-	-	1278.57	1855.57	880.41	948.17	1206.43	1686.75	1416.12	1170.64	1216.41	1605.50	1234.57	11242.60
1988	-	-	-	1124.08	1136.36	965.75	967.25	1565.30	1659.75	1325.97	1466.99	1096.26	1184.60	1369.08	7812.50
1989	-	-	-	936.97	1656.87	742.00	1027.40	1371.16	1678.66	1013.51	1533.22	807.27	862.90	1724.14	7317.07
1990	-	-	-	626.68	1800.33	960.23	1113.26	1941.29	1858.36	1853.87	1498.64	868.52	1090.91	1492.54	7821.23
1991	-	-	-	963.74	1326.70	923.35	1047.38	1381.46	2138.24	1349.95	937.65	901.76	770.71	1526.72	9009.01
1992	-	775.19	-	646.12	910.47	756.80	690.00	911.73	1433.35	1652.89	872.94	864.78	391.39	1033.30	4545.45
1993	-	528.40	-	643.88	1397.33	719.38	552.97	1057.27	989.55	1033.30	963.00	588.90	1315.79	1014.66	5882.35
1994	-	837.21	-	471.20	1134.09	756.36	323.52	841.17	1064.50	833.33	810.95	522.34	704.23	500.56	9909.91
1995	-	1308.26	-	689.66	847.46	785.36	545.65	1206.08	1425.66	814.90	753.65	428.08	818.83	350.06	10869.57
1996	-	561.80	-	491.53	743.19	647.10	623.54	860.22	861.50	383.14	851.47	746.47	865.80	1312.34	8333.33
1997	542.74	684.54	-	478.98	674.37	386.40	507.61	678.73	659.63	904.39	546.20	438.00	328.95	592.11	7142.86
1998	606.06	725.85	-	424.40	654.82	439.01	353.51	793.65	531.11	646.83	564.97	432.90	560.54	147.28	10416.67
1999	1292.78	890.59	195.31	269.69	853.89	433.33	436.11	170.75	862.75	507.61	457.46	503.40	944.39	335.57	9803.92
2000	775.19	538.36	328.14	537.63	93.20	496.96	753.55	419.92	313.48	645.99	1011.49	445.14	277.78	342.47	2040.82
2001	673.40	643.09	488.20	559.60	500.50	461.31	363.47	206.61	711.46	1026.96	988.82	433.20	769.23	586.04	20454.55
2002	884.96	811.12	470.96	331.67	842.99	421.90	727.10	208.33	577.08	1044.39	703.92	453.21	575.26	328.05	9090.91
2003	424.50	1090.25	530.15	520.29	314.14	611.56	719.75	-	485.04	798.93	519.93	375.72	357.78	369.20	11940.30
2004	927.64	2595.80	619.41	533.62	519.75	584.09	353.98	130.98	900.90	262.81	660.19	821.87	285.99	736.31	10769.23
2005	589.10	2211.30	641.03	455.84	509.16	435.41	629.37	700.64	546.88	990.10	570.41	410.54	419.73	1131.73	4687.50
2006	482.51	619.20	200.00	118.62	0.00	261.69	432.12	451.47	79.37	136.80	426.59	324.20	201.41	353.15	8474.58

Table 13. Rates of Musculoskeletal Hospitalizations for Top 15 Light MOS Codes, 1980-2006.

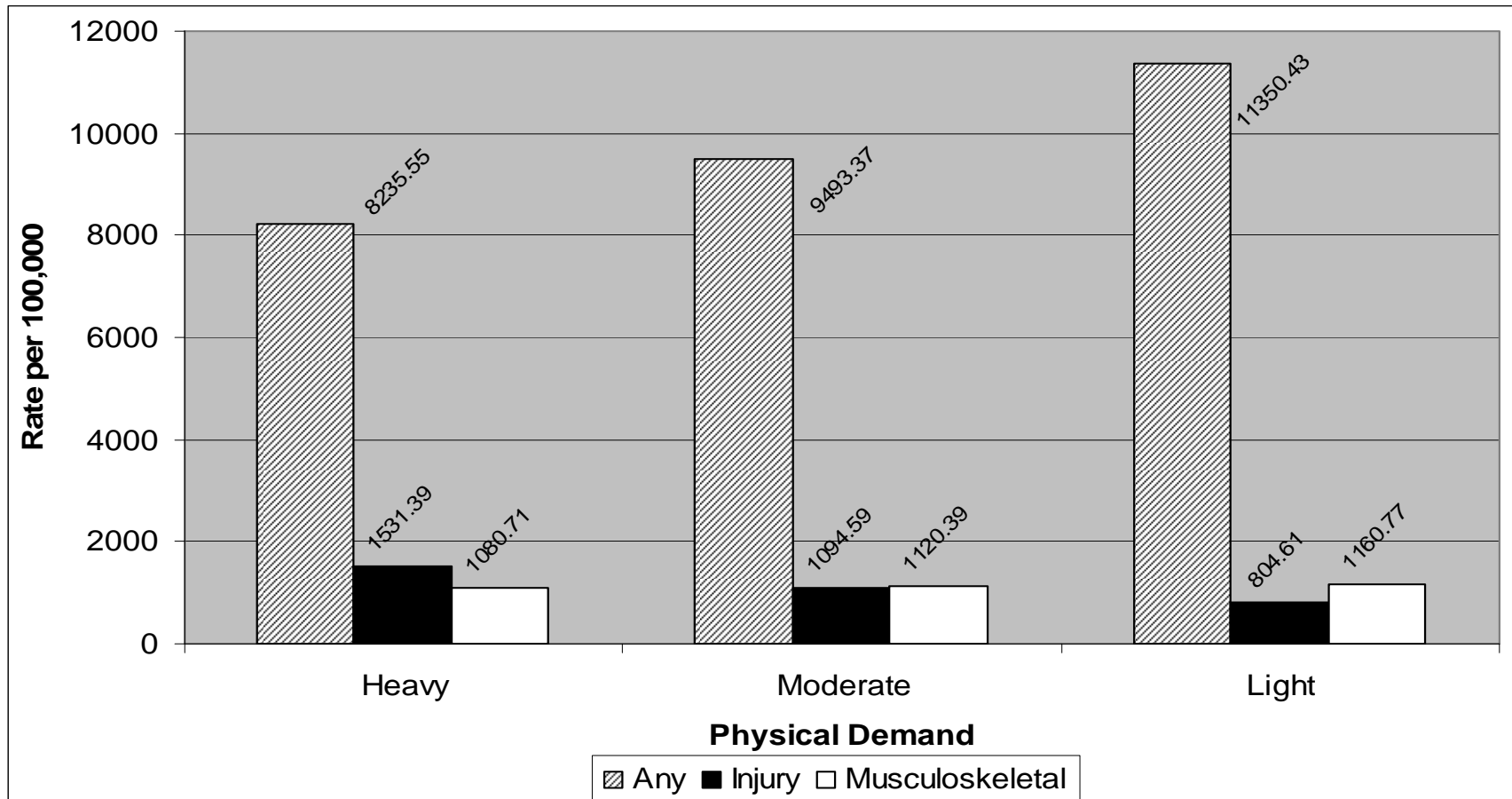
Year	Rate 14E Musculoskeletal Hosps. per MOS pop	Rate 14R Musculoskeletal Hosps. per MOS pop	Rate 33W Musculoskeletal Hosps. per MOS pop	Rate 71D Musculoskeletal Hosps. per MOS pop	Rate 71G Musculoskeletal Hosps. per MOS pop	Rate 71L Musculoskeletal Hosps. per MOS pop	Rate 73C Musculoskeletal Hosps. per MOS pop	Rate 76J Musculoskeletal Hosps. per MOS pop	Rate 91D Musculoskeletal Hosps. per MOS pop	Rate 91S Musculoskeletal Hosps. per MOS pop	Rate 93P Musculoskeletal Hosps. per MOS pop	Rate 96B Musculoskeletal Hosps. per MOS pop	Rate 96D Musculoskeletal Hosps. per MOS pop	Rate 97B Musculoskeletal Hosps. per MOS pop	Rate 97E Musculoskeletal Hosps. per MOS pop
1980	-	-	-	619.20	1532.77	590.48	494.58	642.40	1078.80	605.33	-	586.85	376.41	742.31	725.69
1981	-	-	-	816.15	2461.07	1242.85	1201.70	1553.11	2538.79	701.75	-	907.66	807.54	1161.75	1333.33
1982	-	-	-	1359.97	2215.51	1106.14	861.23	902.71	2441.36	1394.17	-	1299.67	676.59	1881.72	2884.62
1983	-	-	-	1014.80	1661.78	1238.89	1317.47	1384.40	1777.14	1437.13	-	2115.12	1171.30	963.39	1338.83
1984	-	-	-	1280.96	1641.14	1188.22	898.47	1393.40	3062.20	1805.05	881.06	1207.43	862.07	1338.43	1919.72
1985	-	-	-	873.74	1537.62	1243.58	1259.16	1928.78	2532.98	1686.75	1210.19	1270.03	557.88	1144.37	1356.74
1986	-	-	-	1310.72	1757.11	998.35	1136.12	1249.42	3219.51	862.07	1369.17	1805.27	1180.64	1314.83	2139.46
1987	-	-	-	1472.30	3009.03	1328.01	1453.86	1251.12	2795.18	1416.12	1530.84	2149.93	1949.54	1234.57	1879.40
1988	-	-	-	1642.89	2685.95	1375.59	2022.42	1610.02	3042.88	1546.96	1507.74	1978.61	1579.47	1540.22	1766.19
1989	-	-	-	1533.22	2672.37	1564.46	2237.44	1985.82	4028.78	1801.80	1575.81	1992.94	1342.28	1880.88	1625.44
1990	-	-	-	1477.17	2673.21	1606.44	2008.71	2035.98	2913.11	1962.92	2179.84	1785.28	1000.00	1439.23	1848.31
1991	-	-	-	1468.56	2874.52	1851.67	2044.89	2450.98	3431.13	1142.26	1547.12	1850.97	963.39	2344.60	1941.18
1992	-	1550.39	-	1988.07	2883.16	1549.40	1379.99	1906.34	3344.48	1756.20	1357.90	1598.53	2348.34	2296.21	1702.69
1993	-	924.70	-	1040.12	3098.42	1789.68	1571.59	1762.11	4068.17	1951.78	912.32	1906.90	708.50	2649.38	2178.50
1994	-	744.19	-	1675.39	2268.18	1561.92	1747.01	2375.06	3068.25	2619.05	1875.32	1944.28	1106.64	1946.61	1851.85
1995	-	981.19	-	1007.96	3004.62	1659.50	1891.60	2884.11	3258.66	2328.29	2072.54	1655.25	1740.02	1458.58	2074.33
1996	-	842.70	-	1747.68	2064.41	1467.27	1169.13	2365.59	2186.88	1277.14	1655.63	1354.71	2272.73	2559.06	980.39
1997	407.06	684.54	-	691.86	385.36	575.66	507.61	1131.22	1121.37	645.99	591.72	958.12	767.54	657.89	823.42
1998	1136.36	558.35	-	636.60	935.45	376.29	353.51	566.89	455.24	388.10	564.97	676.41	784.75	515.46	596.42
1999	836.50	445.29	292.97	323.62	474.38	425.00	130.83	796.81	549.02	253.81	548.95	629.25	419.73	536.91	313.81
2000	1057.08	269.18	410.17	483.87	745.57	496.96	576.24	419.92	940.44	645.99	643.68	489.65	92.59	513.70	645.16
2001	673.40	707.40	162.73	839.40	1201.20	574.46	90.87	619.83	711.46	770.22	816.85	342.00	480.77	426.21	401.61
2002	707.96	115.87	549.45	608.07	210.75	504.45	339.31	625.00	329.76	783.29	615.93	815.77	383.51	437.40	509.68
2003	1030.93	484.55	331.35	572.32	732.98	516.01	449.84	-	1293.45	532.62	606.59	276.84	357.78	527.43	278.81
2004	742.12	741.66	412.94	693.70	831.60	513.60	389.38	720.37	737.10	394.22	970.87	535.17	285.99	828.35	436.36
2005	1178.20	819.00	569.80	512.82	712.83	616.84	559.44	573.25	703.13	565.77	534.76	342.11	314.80	407.42	384.62
2006	120.63	619.20	333.33	177.94	781.25	279.13	468.13	225.73	555.56	136.80	319.94	340.41	604.23	294.29	129.24

Table 14. Rates of Any Hospitalizations for Top 15 Light MOS Codes, 1980-2006.

Year	Rate 14E Any Hosp per MOS pop	Rate 14R Any Hosp per MOS pop	Rate 33W Any Hosp per MOS pop	Rate 71D Any Hosp per MOS pop	Rate 71G Any Hosp per MOS pop	Rate 71L Any Hosp per MOS pop	Rate 73C Any Hosp per MOS pop	Rate 76J Any Hosp per MOS pop	Rate 91D Any Hosp per MOS pop	Rate 91S Any Hosp per MOS pop	Rate 93P Any Hosp per MOS pop	Rate 96B Any Hosp per MOS pop	Rate 96D Any Hosp per MOS pop	Rate 97B Any Hosp per MOS pop	Rate 97E Any Hosp per MOS pop
1980	-	-	-	5970.81	11205.07	7949.21	6619.75	8832.98	12335.83	9443.10	-	8372.46	8406.52	8165.43	6676.34
1981	-	-	-	11297.25	20090.41	12951.00	11961.55	14779.56	18570.76	14853.80	-	10655.09	8209.96	8310.99	10222.22
1982	-	-	-	11602.21	20896.27	12976.47	13486.01	15245.74	18429.87	15716.10	-	10174.53	11772.67	10663.08	11126.37
1983	-	-	-	11374.21	19452.59	12853.15	14152.15	15182.28	20701.25	13652.69	-	10610.26	9224.01	9730.25	10092.69
1984	-	-	-	11870.20	20623.63	13053.75	13387.24	15606.13	19904.31	15282.79	8810.57	8978.33	6896.55	8699.81	11343.80
1985	-	-	-	11183.92	21142.23	13647.48	12980.77	17161.23	19050.13	14457.83	8089.17	10160.27	7949.79	8978.87	9896.25
1986	-	-	-	13415.57	20000.00	14026.08	13804.93	13836.19	20585.37	16487.07	11206.90	11956.20	10389.61	8619.43	12916.01
1987	-	-	-	14141.81	23119.36	15843.60	15212.81	18811.44	22313.25	18409.59	13372.35	12107.50	13073.39	10246.91	13234.14
1988	-	-	-	14699.52	26446.28	16669.37	15805.67	17531.31	25449.52	15469.61	14180.93	11577.54	11056.27	10781.52	10765.35
1989	-	-	-	13798.98	28968.47	18049.35	16735.16	20803.78	28633.09	17454.95	15715.50	12083.75	13039.31	14158.83	11590.11
1990	-	-	-	14592.66	27114.02	17689.09	15174.25	21543.56	25113.01	18211.56	13941.87	12400.48	11727.27	13699.36	11408.54
1991	-	-	-	14180.82	24599.23	17578.44	15685.79	18226.38	24515.17	13291.80	12751.99	10465.12	12620.42	11668.48	13058.82
1992	-	3100.78	-	13170.97	20940.82	15601.35	13923.11	16493.99	21070.23	18491.74	12415.13	10691.82	13405.09	11595.87	10085.13
1993	-	6472.92	-	10549.78	25030.38	15867.35	13474.97	17004.41	23144.58	16532.72	11758.74	9702.75	10627.53	12965.05	9557.27
1994	-	4372.09	-	12356.02	19346.23	14327.88	12487.87	16674.91	20475.89	13214.29	11150.53	8850.84	10261.57	8453.84	8222.22
1995	-	5805.40	-	10557.03	15331.28	14546.20	12804.66	16203.46	17718.94	16181.61	13283.09	7990.87	9928.35	8226.37	7951.60
1996	-	3581.46	-	11086.84	13294.80	13032.36	11613.41	13494.62	16169.65	11749.68	11447.49	7962.40	9632.03	9580.05	6417.11
1997	3663.50	3536.79	-	7503.99	10693.64	8713.82	8375.63	9276.02	9102.90	7105.94	7510.24	4681.08	6140.35	5131.58	5123.51
1998	6287.88	3964.27	-	7267.90	10196.45	7815.93	7688.91	6292.52	9104.70	7373.87	6450.09	4653.68	5269.06	3092.78	4771.37
1999	6539.92	4643.77	2050.78	6256.74	7969.64	9058.33	6628.87	8252.70	9019.61	6345.18	6450.14	4782.28	3462.75	3758.39	5334.73
2000	6694.86	4306.86	3281.38	6559.14	8667.29	8842.43	8554.96	7918.42	9639.50	5943.15	7126.44	4006.23	3888.89	4509.13	5268.82
2001	4848.48	3987.14	2603.74	7050.92	10710.71	9774.57	8041.80	8539.94	9565.22	8600.77	7781.60	4195.17	5000.00	3462.97	4417.67
2002	5840.71	3939.75	4160.13	7683.80	9799.79	10281.57	9549.20	7916.67	8903.54	5874.67	8754.95	5053.25	5177.37	4483.32	5606.52
2003	6367.50	5996.37	3445.99	7544.22	9319.37	9842.33	8636.98	-	10751.82	8521.97	7885.62	4943.64	4830.05	4219.41	6226.77
2004	6122.45	6365.88	3372.33	8591.25	11122.66	8580.06	6761.06	5435.49	9500.41	7621.55	7844.66	4969.42	4289.80	5062.13	4727.27
2005	5891.02	7043.41	4914.53	7692.31	8044.81	8756.65	8811.19	8343.95	9218.75	7496.46	6737.97	4430.38	3462.75	4391.13	2735.04
2006	1990.35	2941.18	1866.67	3143.53	6835.94	5006.98	4645.30	3950.34	6349.21	2735.98	3697.12	3015.08	2719.03	2589.76	1906.30

Figure 1 displays a summary over the study period comparing risk for each type of hospitalization by occupational demand group. As observed with just the 2000 study population, the overall risk of any-cause hospitalization was greatest among those in the least physically demanding jobs and lowest among those in the heavy-demands MOSs. As hypothesized, Soldiers in heavy demands jobs were at greater risk for injury-related hospitalizations than were Soldiers in moderate or light demands jobs, but they were at lowest risk for musculoskeletal disorders.

Figure 1. Average hospitalization rates for heavy, moderate and light physically demanding jobs, 1980-2006



Tables 15-17 focus more closely on the injury hospitalizations within each physical demand category in order to assess the nature of these injuries. Of all injuries identified in hospitalizations among heavy MOSs, 39% (N=38,193) were sustained either during an on-duty accident or through battle/enemy action. Whereas among moderate-demand MOSs, duty-related injuries accounted for 32% (N=6,596) of the injury hospitalizations and only 26% (N=2,465) of injury hospitalizations among Soldiers in light physically demanding MOSs.

Among heavy physically demanding occupations, 11B (Infantrymen) had the highest percentage of reported “on-duty” injuries (N=12,226; 40.61%). For the moderately physically demanding occupations, 91B (Medical Supply Specialists) had the highest percentage of injuries reported as “on-duty” injuries (N=1,796, 31.27%), and for light demands occupations, 33.85% (N=261) of injuries sustained by Soldiers in 96B (Intelligence Agents) were related to an accident on-duty. The distribution of circumstances under which hospitalized injuries occurred, stratified by job demands, is presented in Tables 15-17.



Table 15. Nature of Injury for Injury-related Hospitalizations among Heavy Physical Demand MOS Codes (N=97,368).

	Nature of Injury									Total
	Enemy Action N Row %	Other Battle Injuries N Row %	Legal Intervention N Row %	Assault N Row %	Self- inflicted N Row %	Accidental, off duty N Row %	Accidental, On Duty N Row %	Duty Status Unknown N Row %	Missing N Row %	
11B	264 0.87%	1,684 5.58%	30 0.10%	1,523 5.04%	975 3.23%	5,881 19.47%	12,266 40.61%	6,590 21.82%	993 3.29%	30,206 31.02%
11C	23 0.50%	149 3.23%	2 0.04%	268 5.81%	199 4.31%	1,020 22.12%	1,721 37.32%	1,099 23.83%	131 2.84%	4,612 4.74%
11M	6 0.17%	89 2.49%	4 0.11%	178 4.98%	114 3.19%	674 18.84%	1,090 30.47%	1,219 34.08%	203 5.68%	3,577 3.67%
12B	62 0.85%	316 4.33%	5 0.07%	409 5.6%	229 3.14%	1,517 20.78%	2,654 36.36%	1,869 25.61%	238 3.26%	7,299 7.50%
13B	34 0.33%	221 2.15%	4 0.04%	701 6.82%	464 4.52%	2,239 21.79%	3,469 33.76%	2,914 28.36%	229 2.23%	10,275 10.55%
19D	59 1.10%	336 6.28%	6 0.11%	261 4.88%	171 3.20%	987 18.44%	2,025 37.84%	1,278 23.88%	229 4.28%	5,352 5.50%
19K	43 0.82%	292 5.60%	0 0.00%	204 3.91%	142 2.72%	853 16.35%	1,824 34.97%	1,557 29.85%	301 5.77%	5,216 5.36%
31R	2 0.07%	21 0.76%	1 0.04%	164 5.93%	156 5.64%	687 24.86%	760 27.5%	865 31.3%	108 3.91%	2,764 2.84%
54B	2 0.11%	33 1.84%	2 0.11%	67 3.75%	89 4.97%	273 15.26%	498 27.84%	719 40.19%	106 5.93%	1,789 1.84%
63B	10 0.14%	70 0.95%	5 0.07%	384 5.22%	294 3.99%	1,858 25.24%	2,264 30.75%	2,234 30.35%	243 3.30%	7,362 7.56%
77F	5 0.16%	54 1.78%	3 0.10%	157 5.17%	140 4.61%	597 19.67%	964 31.76%	943 31.07%	172 5.67%	3,035 3.12%
88M	17 0.22%	161 2.10%	10 0.13%	419 5.46%	362 4.71%	1,864 24.27%	2,343 30.51%	2,284 29.74%	220 2.86%	7,680 7.89%
92A	5 0.34%	28 1.88%	0 0.00%	47 3.16%	62 4.17%	218 14.66%	419 28.18%	508 34.16%	200 13.45%	1,487 1.53%
92G	7 0.70%	29 2.90%	0 0.00%	30 3.00%	47 4.70%	138 13.79%	276 27.57%	290 28.97%	184 18.38%	1,001 1.03%
92Y	6 0.11%	38 0.67%	0 0.00%	344 6.02%	296 5.18%	1,453 25.43%	1,554 27.20%	1,808 31.65%	214 3.75%	5,713 5.87%
Total	545 0.56%	3,521 3.62%	72 0.07%	5,156 5.30%	3,740 3.84%	20,259 20.81%	34,127 35.05%	26,177 26.88%	3,771 3.87%	

Table 16. Nature of Injury for Injury-related Hospitalizations among Moderate Physical Demand MOS Codes (N=20,821).

	Nature of Injury for Moderate Physically Demanding MOS codes (N=20,821)									Total
	Enemy Action N Row %	Other Battle Injuries N Row %	Legal Intervention N Row %	Assault N Row %	Self-inflicted N Row %	Accidental, off duty N Row %	Accidental, On Duty N Row %	Duty Status Unknown N Row %	Missing N Row %	
13M	6 0.62%	36 3.70%	0 0.00%	50 5.13%	53 5.44%	149 15.30%	270 27.72%	355 36.45%	55 5.65%	974 4.68%
14T	0 0.00%	0 0.00%	0 0.00%	4 1.53%	7 2.67%	6 2.29%	37 14.12%	154 58.78%	54 20.61%	262 1.26%
31P	0 0.00%	1 0.47%	0 0.00%	8 3.72%	4 1.86%	54 25.12%	42 19.53%	86 40.00%	20 9.30%	215 1.03%
31S	0 0.00%	1 0.32%	0 0.00%	9 2.92%	9 2.92%	76 24.68%	75 24.35%	114 37.01%	24 7.79%	308 1.48%
31U	4 0.41%	27 2.74%	1 0.10%	34 3.45%	34 3.45%	163 16.53%	259 26.27%	359 36.41%	105 10.65%	986 4.74%
35E	1 0.58%	2 1.16%	0 0.00%	8 4.65%	6 3.49%	23 13.37%	47 27.33%	60 34.88%	25 14.53%	172 0.83%
67R	5 1.32%	2 0.53%	0 0.00%	12 3.17%	7 1.85%	95 25.13%	74 19.58%	145 38.36%	38 10.05%	378 1.82%
74C	0 0.00%	0 0.00%	0 0.00%	5 3.09%	13 8.02%	31 19.14%	31 19.14%	44 27.16%	38 23.46%	162 0.78%
75B	1 0.06%	12 0.72%	1 0.06%	77 4.61%	103 6.17%	414 24.79%	426 25.51%	517 30.96%	119 7.13%	1670 8.02%
75H	1 0.41%	0 0.00%	0 0.00%	6 2.44%	5 2.03%	48 19.51%	58 23.58%	96 39.02%	32 13.01%	246 1.18%
88N	0 0.00%	3 1.02%	0 0.00%	9 3.06%	10 3.40%	68 23.13%	75 25.51%	100 34.01%	29 9.86%	294 1.41%
91B	21 0.37%	160 2.79%	3 0.05%	250 4.35%	337 5.87%	1206 21.00%	1796 31.27%	1733 30.17%	238 4.14%	5744 27.59%
91K	0 0.00%	2 0.33%	1 0.17%	18 3.00%	31 5.17%	152 25.33%	132 22.00%	235 39.17%	29 4.83%	600 2.88%
95B	24 0.30%	242 3.00%	7 0.09%	294 3.64%	365 4.53%	1850 22.94%	2536 31.44%	2444 30.30%	304 3.77%	8066 38.74%
98C	0 0.00%	0 0.00%	1 0.13%	18 2.42%	36 4.84%	209 28.09%	187 25.13%	244 32.80%	49 6.59%	744 3.57%
Total	63 0.30%	488 2.34%	14 0.07%	802 3.85%	1020 4.90%	4544 21.82%	6045 29.03%	6686 32.11%	1159 5.57%	

Table 17. Nature of Injury for Injury-related Hospitalizations among Light Physical Demand MOS Codes (N=9,566).

	Nature of Injury for Light Physically Demanding MOS codes (N=9,566)									Total
	Enemy Action N Row %	Other Battle Injuries N Row %	Legal Intervention N Row %	Assault N Row %	Self- inflicted N Row %	Accidental, off duty N Row %	Accidental, On Duty N Row %	Duty Status Unknown N Row %	Missing N Row %	
14E	0 0.00%	0 0.00%	0 0.00%	0 0.00%	4 3.88%	12 11.65%	14 13.59%	55 53.40%	18 17.48%	103 1.08%
14R	0 0.00%	23 11.50%	0 0.00%	8 4.00%	6 3.00%	18 9.00%	53 26.50%	66 33.00%	26 13.00%	200 2.09%
33W	0 0.00%	0 0.00%	0 0.00%	1 2.13%	1 2.13%	6 12.77%	11 23.40%	10 21.28%	18 38.30%	47 0.49%
71D	0 0.00%	1 0.24%	0 0.00%	14 3.41%	17 4.14%	104 25.30%	112 27.25%	146 35.52%	17 4.14%	411 4.30%
71G	0 0.00%	1 0.21%	1 0.21%	14 2.97%	38 8.05%	111 23.52%	107 22.67%	189 40.04%	11 2.33%	472 4.93%
71L	0 0.00%	5 0.12%	0 0.00%	195 4.63%	273 6.48%	1201 28.5%	954 22.64%	1409 33.44%	177 4.20%	4214 44.05%
73C	1 0.13%	3 0.39%	0 0.00%	26 3.36%	34 4.40%	203 26.26%	193 24.97%	286 37.00%	27 3.49%	773 8.08%
76J	0 0.00%	1 0.20%	0 0.00%	23 4.57%	25 4.97%	102 20.28%	128 25.45%	207 41.15%	17 3.38%	503 5.26%
91D	0 0.00%	3 0.49%	0 0.00%	26 4.27%	40 6.57%	154 25.29%	173 28.41%	205 33.66%	8 1.31%	609 6.37%
91S	0 0.00%	3 1.26%	0 0.00%	6 2.52%	14 5.88%	53 22.27%	65 27.31%	88 36.97%	9 3.78%	238 2.49%
93P	0 0.00%	2 0.46%	0 0.00%	9 2.08%	23 5.32%	105 24.31%	100 23.15%	158 36.57%	35 8.10%	432 4.52%
96B	0 0.00%	11 1.43%	1 0.13%	23 2.98%	21 2.72%	159 20.62%	261 33.85%	251 32.56%	44 5.71%	771 8.06%
96D	0 0.00%	1 0.52%	0 0.00%	5 2.59%	10 5.18%	53 27.46%	55 28.50%	56 29.02%	13 6.74%	193 2.02%
97B	1 0.28%	9 2.51%	0 0.00%	7 1.96%	5 1.40%	77 21.51%	109 30.45%	125 34.92%	25 6.98%	358 3.74%
97E	0 0.00%	0 0.00%	1 0.41%	6 2.48%	10 4.13%	65 26.86%	65 26.86%	83 34.30%	12 4.96%	242 2.53%
Total	2 0.02%	63 0.66%	3 0.03%	363 3.79%	521 5.45%	2423 25.33%	2400 25.09%	3334 34.85%	457 4.78%	

## DISCUSSION

As hypothesized, we found that the odds for experiencing an injury hospitalization increased with increasing level of physical demand. In contrast, the odds of experiencing a hospitalization for any cause were lowest for Soldiers in the highest physical demands jobs, followed by moderate demands, with Soldiers in the light demands jobs at greatest risk for any-cause hospitalization.

There are several possible reasons for these associations. First, the odds ratios for the year 2000 and the average annual rates evaluated for the 1980-2006 study period are not adjusted by gender or age. Since we know that women comprise a larger percentage of light occupations, these increased overall hospitalization rates may reflect greater risk for hospitalizations for a variety of gender-specific causes such as childbirth.

It is also possible that these observed rates and odds ratios reflect a “healthy worker effect” or selection bias in that those with more overall health conditions either do not choose to enter or are not placed in heavier physically demanding jobs. Rather, those more likely to experience a hospitalization of any nature could be serving in lighter physically demanding categories.

A third possible explanation is that while heavy demands jobs place a Soldier at greater risk for acute injury, they also are protective against other types of problems and possible musculoskeletal disorders. In contrast, light demands jobs may be more sedentary and thus increase risk for certain chronic musculoskeletal problems (e.g., back pain) and/or problems other than acute injury.

The finding that Soldiers in heavy demands jobs were at greater risk for injury-related hospitalizations than were Soldiers in moderate or light demands jobs may, in part, validate the physical demand classification of a particular MOS. It also raises questions about whether the Army should employ a more appropriate method to evaluate and ensure proper matching of Soldiers to occupations so that job assignment reflects physical capabilities. Better assessment of physical capabilities and then careful matching to jobs by demands may reduce the risk for on-the-job acute injuries.

On the other hand, it is possible that heavy physically demanding jobs themselves may be so hazardous that even well-trained and fit Soldiers will still be at increased risk for injuries. A greater proportion of the injuries experienced by Soldiers in high-demands jobs occurred while they were on duty, suggesting that their jobs are, in fact, potentially hazardous. In contrast, Soldiers working in light demands jobs were both less likely to be injured and, if they were injured, the injury was less likely to have occurred while on the job or during training. If there is still excess injury, even after better assessment and matching of Soldiers to jobs, then it might be necessary to re-evaluate the ergonomics of the jobs and identify ways to better protect Soldiers in heavily demanding jobs. More research is needed to clarify whether better assessment

and assignment will mitigate excess injury risk experienced by Soldiers in jobs that have heavy physical demands. In addition, an assessment of the long-term effects of occupational exposures via increased risk for disability and other adverse outcomes should also be undertaken.

## **STRENGTHS AND LIMITATIONS**

The classification of military occupational specialties by levels of physical demand, particularly the construction of a crosswalk to examine occupations across a 27-year period, is a significant strength of this report. While individual MOS codes can be identified by physical demand in AR 611-21, the ability to group multiple common occupations by physical demand level allows for a more in-depth look at physical demand categories as a whole. Moreover, by following occupations over time and documenting coding changes, we were able to learn much more about the evolution of specific military occupations than basic frequencies from 1980-2006 would have allowed. Instead, we were able to track temporal trends in hospitalization rates among Soldiers within the same occupations of interest over time. If instead we had used only a specific MOS code at one given point in time for a given occupation, this opportunity would have been lost. This crosswalk allows for larger occupational cohorts and to examine the link between exposures to light, moderate and heavy demand jobs and adverse health outcomes.

Another key strength of this study was the linkage of physical job demands with objective health outcomes data. This linkage allows us to assess the relative utility of the job demands scale for identifying demanding jobs and also points to the need to continue working to reduce injury risk in these high demands jobs. Because on-the-job injuries are still a problem within high demand jobs, it is clear from these data that more needs to be done to match Soldiers to the demands of these jobs and more needs to be done to protect Soldiers engaged in these highly demanding jobs. More research documenting the nature and type of injury among highly demanding jobs, as well as long-term consequences, such as disability, would be useful for focusing ergonomic assessments and job redesign efforts.

A limitation of the crosswalk process is that while we are confident that we captured many coding changes and restructuring of specific occupations, we cannot be certain that all changes were accounted for. There are no central records documenting historical changes in MOS coding conventions, so we have no way of confirming that we did, in fact, account for all coding transitions. Additionally, when a certain code was changed, dropped or added, we cannot guarantee that coders began applying these new codes at the time they were implemented. We found strong evidence suggesting that, in fact, there often was a delay in implementing MOS code changes, especially when some occupational codes were discontinued and later replaced by alternative codes. Rather than seeing the original code drop off and the new code immediately populated, there were sometimes considerable counts of Soldiers holding the original “discontinued” code, even after it was supposedly dropped.

While our large occupational cohorts allowed us to identify trends in hospitalizations, the results from this preliminary analysis are unadjusted. Thus, we cannot disentangle the influences of certain body composition or exposure factors, such as gender, age or other demographic factors and injury outcomes. Future work should include adjustments for gender, age and other key demographic factors associated with both job demands, other risk exposures and occupational injury.

We focused on primary ICD-9-CM clinical diagnoses to determine if a hospitalization was injury- or musculoskeletal-related. Thus, it is possible that we are missing important linkages or patterns between injuries or musculoskeletal conditions and physical demand categories. We may miss, for example, common comorbid musculoskeletal conditions that resulted from an occupational injury. We did not evaluate disability rates for individuals within certain physically demanding occupations. However, evaluating long-term effects of occupational physical demands is warranted and should be included in future research efforts.

Despite these limitations, this study was still able to provide a detailed picture of the association between the physical demands of military occupations and risk for serious adverse health events (hospitalization). Our ability to link biannual personnel records with hospitalization data at the individual level is a unique strength of this study. Using the TAIHOD database, we were able to study a relatively large sample of Soldiers over a 27 year period, as well as learn about MOS coding patterns throughout that time.

## CONCLUSIONS AND RECOMMENDATIONS

- Injury hospitalization rates, as well as data on whether injuries are job-related, suggest that military occupations are generally accurately classified as light, moderate and heavy physical demands.
- The higher incidence of injury among Soldiers assigned to heavy physically demanding jobs might suggest that the assignment and reclassification processes are in need of revisions or more thorough implementation. Alternatively, it could suggest that the demanding nature of these jobs still results in greater injury risk even among those Soldiers who are most physically fit.
- Lighter physically demanding jobs have higher rates of any-cause hospitalizations, whereas heavier physically demanding occupations have higher rates of injury-specific hospitalizations. This may be due to greater proportions of women in light-demands jobs who are also at greater risk for hospitalizations. It could also reveal a healthy-worker type of bias, where the screening process places those who are more vulnerable to illness in less physically demanding jobs, or less-demanding jobs themselves may result in a less fit workforce at greater risk for many adverse health problems (except acute injury).
- On-duty serious accidents (those resulting in an injury hospitalization) occur more frequently among heavy physically demanding jobs. Soldiers in 11B (Infantrymen), 19D (Cavalry Scout) and 11C (Indirect Fire Infantrymen) were at greatest risk for on-the-job injuries resulting in hospitalization within heavy physically demanding occupations.
- The dynamic nature of MOS nomenclature over time makes the study of any temporal patterns or risk factors for injury or disability within an occupational cohort difficult. The ability to crosswalk MOS codes over time is a great advantage for the study of any long-term health or behavioral trends among specific military occupations of interest.
- Identifying MOS codes according to their assigned level of physical demand can help determine differential risk factors for injury. Such information can be used to develop targeted interventions for specific occupations within the military.
- More research is needed that explores long-term chronic conditions and disability related to occupational physical demand and to clarify the independent influence of job demands once demographic factors are controlled.

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